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Montreal, 26-28 July 1995

PROJECT PROPOSALS: ARGENTINA

This document includes the following project proposals which have been grouped by sector. The agency responsible for the implementation of the project is also indicated. The project proposals are presented in the order indicated below.

Foam

• Conversion to non-CFC technology in the manufacture of flexible foam (slabstock) at Limansky	UNDP
• Conversion to non CFC technology in the manufacture of flexible foam (slabstock) at Sueno Estelar S.A. and Estelar San Luis S.A.	UNDP

Refrigeration

• Conversion to non-CFC technology in the production of mobile air conditioning systems at Sistemaire S.A.	World Bank
• Elimination of CFCs in domestic refrigerator production plant in Autosal, S.A.	World Bank
• Elimination of CFCs in the manufacturing plant of domestic refrigerators of Briket S.A.	World Bank
• Elimination of CFC in the manufacturing plant of domestic refrigerators of Neba S.A.	World Bank

PROJECT COVER SHEET

Country:	ARGENTINA
Project Title:	LIMANSKY conversion to non CFC technology in the manufacture of flexible foam (slabstock).
Sector Covered:	Foam
ODS used in Sector	1585 tons CFCs (ODP - base year 1992)
Project Impact:	95 Tons of CFC-11 (base year 1994)
Project Duration:	One (1) year
Project Economic Life:	Ten (10) years
Total Project Costs:	US$ 533,000
Proposed MLF Grant:	US$ 533,000 (reflects 100 % local ownership)
Cost Effectiveness:	5.61 US$/kg/year
National Coordinating Body:	OPROZ -- INTI
Implementing Agency:	UNDP
Appraisal Date:	April, 1995

PROJECT SUMMARY

Under this project, LIMANSKY S.A. will phase out the use of CFCs in the manufacture of flexible foam slabstock by all water blown technology. The project includes a forced cooling system for energy dissipation, the use of additives for required softness, costs for trials, training and technology transfer and operational incremental costs.

Project prepared by: INTI - Eng. María Lucía Gomez
UNDP - Mr. Bert Veenendaal

Independent Technical Review: Dr. Hubert Creyf

PROJECT OF THE GOVERNMENT OF ARGENTINA

LIMANSKY CONVERSION TO NON CFC TECHNOLOGY IN THE MANUFACTURE OF FLEXIBLE FOAM SLABSTOCK

1. GENERAL BACKGROUND

The country program of the Government of Argentina for the protection of the ozone layer was presented and approved at the 13th Executive Committee Meeting of the Multilateral Fund of the Montreal Protocol. This country program contains the intention of the Government and the industry to reduce and phase out the consumption of ozone depleting substances (ODS).

This country program calls for a total phase out of the ODS in year 2006, and reductions in advance to the scheduled data established for the Montreal Protocol and their amendments. Reasons for such a policy are the environmental impact as well as future international restrictions to the product that contains this substances.

The ODS consumption in Argentina was 1,338 ton of CFC-11 and 2,408 ton of CFC-12 during the year 1992, base of the country program. Due to the growth of the sectors that use ODS, the consumption has increased approximately 7% during 1993 and would increase 6% during 1994.

2. SECTOR BACKGROUND

In 1992, the Argentine foam industry consumed 1,484 tons of CFCs (1484 tons ODP). CFC 11 was the dominant substance (1,275 tons) followed by CFC 12 (209 tons). The sector can be functionally divided into:

* Non-insulating foams
    - flexible foams (slabstock)
    - flexible and semirigid foams (molded)
    - extruded foams

* Insulation foams
    - domestic refrigeration
    - commercial refrigeration

CFC use per category is indicated in the following table:

Table 1: CFC use per foam category (ton, 1992)

CATEGORY	CFC 11	CFC 12
Rigid insulation - commercial & domestic refrigerators	343	
Rigid insulation - panels, vehicles	274	
Flexible - slabstock	431	
Flexible/semirigid - molded	135	
Other PUF applications	42	
Extruded foams (XPS/PE foams)	50	209
TOTAL	1,275	209

The country program calls for a phase out of CFCs in the non insulating foams in or before 1998. Insulating foams are scheduled to be phased out in or before the year 2000.

Insulation foams for domestic and commercial refrigeration will be phased out jointly with the corresponding refrigerant.

Insulating foam manufacture for panels is dominated by a few large manufacturers, which manage from 80 to 90% of the market and many small producers. The CFCs consumption in this sector was, in 1992, 141 tons. Insulating foam panels are widely used for modular and fixed cold stores, such as for common warehouses and large buildings (roof and top). The strategy calls for a combination of individual (about five) projects and one or two group projects. An early project (particularly in this case, with cyclopentane) will serve as demonstration project, taking into account all the safety measurements required for an hydrocarbon project and will encourage other enterprises to come forward and to present their own projects.

PUR insulating rigid foams are also used in the construction of vehicles (trucks), refrigerated trucks and isothermic box (containers) for transport. In this subsector there are also a few large manufacturers and some small producers.

Molded foams are predominantly used in the automotive and furniture industry. Products include seat cushions, steering wheels, arm rests and chair legs. The strategy calls for the preparation of a few early phase out projects to demonstrate the technical and economic feasibility of CFC replacement.

There are only a few enterprises producing extruded foams (polyethylene and polystyrene foam sheet). Products are used in the fast food industry and for packaging purposes. CFC phase out will be addressed through individual projects.

In the flexible foam (slabstock) category there are eight manufacturers operating continuous production lines. In addition, there are about 25 producers using "single block" production equipment, of which about 7 have considerable foam production (leading to considerable CFCs consumption), while the remaining companies are very small producers. Products are aimed at the bedding industry, with smaller applications in furniture and miscellaneous industrial uses as packaging, household. The ODS phase out strategy calls for individual projects for the large producers (since lay out and machinery allocated in each company require different solutions for each one) and a joint project for the small scale producers.

The flexible foam sector generally uses CFC-11 as an auxiliary blowing agent. Some companies have begun to introduce methylene chloride (MC), mainly because of the higher cost of CFC-11, but the methylene chloride emissions are regulated by federal laws. In Argentina, methylene chloride concentration in exhaust gases, introduced in the atmosphere have to be less than 0.17 ppm, which effectively rules out the use of MC in foam operations. The Secretary of the Human Environmental and Natural Resources (Secretaría de Recursos Naturales y Ambiente Humano) is presently working on additional regulations for this substance since it is also considered a hazardous waste.

3. OBJECTIVE

The objective of this project is to phase out the use of CFC-11 in the manufacture of flexible foam slabstock at LIMANSKY S.A. plant, through the introduction,of all water blown technology.

4. ENTERPRISE BACKGROUND

Limansky S.A. is one of the larger flexible foam manufacturers in Argentina. The company is a family owned company, 100% Argentinean owned. It started operations in 1930, producing mattresses. Foaming operations began in 1982 with box foaming type machinery. In 1992 the company bought a continuous foaming machine. It has currently 183 employees, from which 120 belong to production.

Limansky S.A. produces slabstocks, (densities between 14 and 35 kg/m3), mattresses and pillows for bedding, and foam for furniture. The company has three stores (Buenos Aires, Rosario and Córdoba) selling directly to the public, and a distribution network. In 1982 the foam production was 5 tons/month, which grew up to 200 tons/month presently, so growth has been about 20% over the last few years, a tendency which is expected to continue. Limansky provide mainly for the local market with some exports to Uruguay (less than 10%)

The following table shows the production equipment:

EQUIPMENT	OUTPUT	YEAR	PRODUCTION
CANNON VIKING MAX FOAM	250 kg/min	1992	180 tons/month
Box Foam unit (home made)	N/A	1982	20 tons/month

LIMANSKY S.A. has partially reduced its CFCs use replacing it by methylene chloride, but taking into account the restrictions enforced by the Government regarding methylene chloride, this process has stopped. The following table shows the CFCs consumption during the last years:

PERIOD	CFC 11	Methylene Chloride
April 1992 to March 1993	90 Ton	0 Ton
April 1993 to March 1994	84 Ton	11 Ton
April 1994 to March 1995	84 Ton	11 Ton

5. TECHNOLOGY SELECTION CRITERIA AND IMPACT

5.1. Overview and Selection

There are several options to replace CFCs in the manufacture of flexible polyurethane slabstock. They are described and reviewed in the Multilateral Fund's document UNEP/OZ L.Pro/Ex.Com./16/Inf3: Flexible Polyurethane foams options to reduce/eliminate the use of CFCs. The use of methylene chloride is one of them, but the Argentine Government does not accept this option, because:

a) during foaming process the M.C. concentration in exhaust gases are higher than allowed as per pertinent federal regulations.

b) in the future this substance will be submitted to even stricter controls and regulations on that are currently being drafted.

Methylene Chloride is therefore not feasible as a replacement technology for CFC-11 in the argentine flexible foam sector, but it could be allowed for a restricted interim period, in those projects where transition periods are needed to adjust all the formulations. Such is the case of all water system plus forced cooling process plus additives, as well as for the "low index technology".

It should also be noted that LIMANSKY produces a lot of different slabstock densities and qualities, and that the use of methylene chloride in some of them causes severe scorching.

To phase out CFC-11 consumption LIMANSKY has decided to replace CFC-11 by water, using a forced cooling system to dissipate excess process energy and the use of additives to achieve the required softness.

5.2. Impact on Production Process.

The installation of a forced cooling system (FC) will reduce the need for curing space, but will increase the required space in the production area to allocate this system. A backup generator has to be installed to avoid fire risk in case of a power outing. The technology requires an additional polyol and the use of additives.

Fire fighting equipment has to be adjusted to the new lay out. Safety and production training is required following installation, prior and during start-up. The start-up will be supervised by UNDP experts.

5.3. Description of the Proposed Reconversion.

Maintaining present facilities, the following is required:

* installation of an FC system
* installation of additive system and additional polyol system
* modification of conveyors.
* a back-up generator
* a fire fighting system
* a fire wall separating production from fabrication
* reallocation of the fabrication area
* build a wall to separate the new cutting area to avoid fire risk.

6. PROJECT COSTS

6.1. Capital Costs

The following is a summary of the expected costs of investments and related activity, including equipment, training, testing, and technology transfer:

Item	US$
Forced cooling system	275.000
Additive system	15.000
Polyol system	35.000
Emergency Power Generator	35.000
Modification of the conveyor	5.000
Fire fighting system	10,000
Shipping and insurance costs	15,000
Start-up and Trial materials	21.000
Technology Transfer	20.000
Lay out modifications (cutting area moving, wall)	15.000
Contingency (10% capital costs)	44,000
Total	490,000

6.2. Operating Costs

The introduction of additives combined with the use of all water blown technology will be a comprehensive process and the operating cost after conversion are highly dependent on the final choice of the formulation, which will be determined during process trials.

Annex I provides a consolidation of the effect of the various changes on the operating costs. The incremental operational (NPV) for four years amounts to US$ 43,000.

6.3. Cost Effectiveness

Item	Units	Value
a) Capital costs	US$	**490,000**
b) Operating Costs / year	US$/year	**13,500**
c) Operating Costs, NPV (four years)	US$	**43,000**
d) ODS Reduction/year	kg	**95,000**
e) Capital recovery factor		**0.16275**

Unit abatement costs (a x e + b)/d	US$/kg/year	**0.98**

Cost effectiveness (a + c)/d	US$/kg/year	**5.61**

7. PROJECT FINANCING

Limansky S.A. request the donation of 100% of the project costs, reflecting the 100 % local ownership, amounting to **US$ 533,000**

8. PROJECT TIMETABLE

Activity	Trim 1	Trim 2	Trim 3	Trim 4
1. Preparation:				
License Agreement	x			
Procurement	x			
Vendor Selection	x			
2. Installation:				
Arrival. customs		x x x	x	
Installation			x x x	
Training (safety)				x
3. Start-up:				
Machine Start Up				x x
Trials				x
Training (in process)				x x
Certification				x

9. REGULATORY ACTION

This project will not require regulatory actions.

10. PROJECT IMPACT

This project will eliminate the use of, at least, 95 tons of CFC-11 in the first year of implementation. The projects uses commercially and environmentally acceptable technology .

ANNEX I - Incremental Operational Costs

Before:	95 t. CFC 11	US$ 2.4	US$ 228,000
After:	95 t. TDI (see note 2)	US$ 2.1	US$ 199,500
	5 t . softener	US$ 7.5	US$ 37,500
	More energy (45,000 kw)	US$ 0.1	US$ 4,500
	Total		US$ 241,500

Incremental operating costs per year	US$ 13,500
Net present Values, 10% per year, four years	US$ 43,000

<u>Note 1:</u> The introduction of special polyol will reduce the use of the additive. The net financial impact is thought to be about neutral.

<u>Note 2:</u> The additional TDI needed, reacts with water, which replaces CFC with an approximate 1:1 ratio.

ANNEX II: Comparison between existing and required equipment.

CFC 11	WATER BLOWN TECHNOLOGY
Foaming unit: CANNON VIKING - MAX FOAM, output 250 kg min	Same foaming unit. Incorporation of additive and other polyol systems.
Box foaming unit, without identification, output 20 t/month	Same foaming unit, without further modifications
	Forced cooling tunnel

TECHNICAL REVIEW.

1.Country:

Argentina.

2.Project Title:

Limansky conversion to non CFC technology in the manufacture of flexible foam (slabstocks).

3.(Sub)Sector:

Foamed plastics.

4.CP-Relationship:

The CP for the Argentine Government for the ozone layer protection was approved at the 13th Executive Committee Meeting of the MLF of the Montreal Protocol.It contained the intention of the Government and Industry to phase out the use of ODS by 2006 in general, and before 1998 in the non-insulating foams.

5.Technology:

The technology to substitute CFC11 with water, and additional forced cooling, in the production of flexible slabstock PUF, is fully acceptable. It has been developed in the US and is particularly suitable for foams with a thin skin.
Compared to the methylenechloride process, this technology will generate higher chemical costs (different polyol and softening agents) but provides space savings.
The fire risk is slightly increased.
It is suggested that LIMANSKY considers whether the CarDio process is not mature enough to be considered seriously.

6.Environmental Impact:

CFC11 is replaced by water, generating carbondioxide.
The GWP of CO_2 is only 0.025 % of the GWP of CFC11.

(42)

7.Project Costs:

It is unclear to how many plants the proposed costs refer. It is supposed to be only one plant.
The reviewer believes that local firms can build the hardware for a foreced cooling system at a much lower cost than USD 490,000 (eg USD 250,000).
It is further not mentioned why existing polyol systems cannot be used in the new technology.
Of the different cost elements not much explanation is given, so it is difficult for the reviewer to judge their correctness.
The incrementel operating costs are correct.
Assuming the capital and operating costs given, the price to eliminate 1 kg of CFC11 is USD (53,000 / 84,000) or USD 6,58.

8.Implementation:

Can be accepted as proposed.

9.Recommendation:

It is proposed to carefully review the costs as described in chapter 7 of this review. Hereafter it is recommended to accept the project.

Prepared by Hubert Creyf, UNDP Foam Sector Reviewer.
Date:060395. H Creyf

After discussion with Mr B. Veenendaal, Foam Sector Expert, the raised technical questions were solved, and project costs were agreed upon.
It is hence recommended to accept the project.

Hubert Creyf, Foam Sector Technical Reviewer.
Date, 061195. H Creyf

PROJECT COVER SHEET

Country:	**ARGENTINA**
Project Title:	**SUEÑO ESTELAR S.A and ESTELAR SAN LUIS S.A. conversion to non CFC technology in the manufacture of flexible foam (slabstock).**
Sector Covered:	**Foam**
ODS used in Sector:	**1585 tons CFCs (ODP-base year 1992)**
Project Impact:	**128,6 Tons of CFC-11 (base year 1992-94)**
Project Duration:	**One (1) year**
Project Economic Life:	**Ten (10) years**
Total Project Costs:	**US$ 745,000**
Proposed MLF Grant:	**US$ 745,000 (reflects 100 % local ownership)**
Cost Effectiveness:	**5.79 US$/kg/year**
National Coordinating Body:	**OPROZ - INTI**
Implementing Agency:	**UNDP**
Appraisal Date:	**May, 1995**

PROJECT SUMMARY

Under this project, SUEÑO ESTELAR S.A.and ESTELAR SAN LUIS S.A. will phase out the use of CFCs in the manufacture of flexible foam slabstock, through all-water-blown technology. The project includes a forced cooling system for energy dissipation, additives system, costs for trials, training and technology transfer, at both the Buenos Aires and San Luis plants.

Project prepared by: INTI - Eng. María Lucía Gomez
UNDP - Mr. Bert Veenendaal

Independent Technical Review: Dr. Hubert Creyf

PROJECT OF THE GOVERNMENT OF ARGENTINA

SUEÑO ESTELAR S.A. and ESTELAR SAN LUIS S.A. CONVERSION TO NON CFC TECHNOLOGY IN THE MANUFACTURE OF FLEXIBLE FOAM SLABSTOCK

1. GENERAL BACKGROUND

The country program of the Government of Argentina for the protection of the ozone layer was presented and approved at the 13th Executive Committee Meeting of the Multilateral Fund of the Montreal Protocol. This country program contains the intention of the Government and the industry to reduce and phase out the consumption of ozone depleting substances (ODS).

This country program calls for a total phase out of the ODS in year 2006, and reductions in advance to the scheduled data established for the Montreal Protocol and their amendments. Reasons for such a policy are the environmental impact as well as future international restrictions to the product that contains this substances.

The ODS consumption in Argentina was 1,338 ton of CFC-11 and 2,408 ton of CFC-12 during the year 1992, base of the country program. Due to the growth of the sectors that use ODS, the consumption has increased approximately 7% during 1993 and would increase 6% during 1994.

2. SECTOR BACKGROUND

In 1992, the Argentine foam industry consumed 1,484 tons of CFCs (1484 tons ODP). CFC-11 was the dominant substance (1,275 tons) followed by CFC-12 (209 tons). The sector can be functionally divided into:

* Non-insulating foams
    - flexible foams (slabstock)
    - flexible and semirigid foams (molded)
    - extruded foams

* Insulation foams
    - domestic refrigeration
    - commercial refrigeration

CFC use per category is indicated in the following table:

Table 1: CFC use per foam category (ton, 1992)

CATEGORY	CFC-11	CFC-12
Rigid insulation - commercial & domestic refrigerators	343	
Rigid insulation - panels, vehicles	274	
Flexible - slabstock	431	
Flexible/semirigid - molded	135	
Other PUF applications	42	
Extruded foams (XPS/PE foams)	50	209
TOTAL	1,275	209

The country program calls for a phase out of CFCs in the non insulating foams in or before 1998. Insulating foams are scheduled to be phased out in or before the year 2000.

Insulation foams for domestic and commercial refrigeration will be phased out jointly with the corresponding refrigerant.

Insulating foam manufacture for panels is dominated by a few large manufacturers, which manage from 80 to 90% of the market and many small producers. The CFCs consumption in this sector was, in 1992, 141 tons. Insulating foam panels are widely used for modular and fixed cold stores, such as for common warehouses and large buildings (roof and top). The strategy calls for a combination of individual (about five) projects and one or two group projects. An early project (particularly in this case, with cyclopentane) will serve as demonstration project, taking into account all the safety measurements required for an hydrocarbon project and will encourage other enterprises to come forward and to present their own projects.

PUR insulating rigid foams are also used in the construction of vehicles (trucks), refrigerated trucks and isothermic box (containers) for transport. In this subsector there are also a few large manufacturers and some small producers.

Molded foams are predominantly used in the automotive and furniture industry. Products include seat cushions, steering wheels, arm rests and chair legs. The strategy calls for the preparation of a few early phase out projects to demonstrate the technical and economic feasibility of CFC replacement.

There are only a few enterprises producing extruded foams (polyethylene and polystyrene foam sheet). Products are used in the fast food industry and for packaging purposes. CFC phase out will be addressed through individual projects.

In the flexible foam (slabstock) category there are eight manufacturers operating continuous production lines. In addition, there are about 25 producers using "single block" production equipment, of which about 7 have considerable foam production (leading to considerable CFCs consumption), while the remaining companies are very small producers. Products are aimed at the bedding industry, with smaller applications in furniture and miscellaneous industrial uses as packaging, household. The ODS phase out strategy calls for individual projects for the large producers (since lay out and machinery allocated in each company require different solutions for each one) and a joint project for the small scale producers.

The flexible foam sector generally uses CFC-11 as an auxiliary blowing agent. Some companies have begun to introduce methylene chloride (MC), mainly because of the higher cost of CFC-11, but the methylene chloride emissions are regulated by federal laws. In Argentina, methylene chloride concentration in exhaust gases, introduced in the atmosphere have to be less than 0.17 ppm, which effectively rules out the use of MC in foam operations. The Secretary of the Human Environmental and Natural Resources (Secretaría de Recursos Naturales y Ambiente Humano) is presently working on additional regulations for this substance since it is also considered a hazardous waste.

3. OBJECTIVE

The objective of this project is to phase out the use of CFC-11 in the manufacture of flexible foam slabstock at SUEÑO ESTELAR S.A.and ESTELAR SAN LUIS S.A. plant.

4. ENTERPRISE BACKGROUND

SUEÑO ESTELAR S.A. and ESTELAR SAN LUIS S.A., are one of the largest flexible foam manufacturers in Argentina. The companies are owned by a family, and have a common management. They are 100% Argentinean owned. Operations started in 1982 in Buenos Aires and in 1986 in San Luís, producing mattresses, pillows and bedding. It has currently 137 employees in Buenos Aires and 45 employees in San Luís. The production at the Buenos Aires plant represents 60% of the total volume, and Estelar San Luís S.A. the remaining 40%

The two companies produce slabstock, (densities between 14 and 30 kg/m3), mattresses and pillows and bedding, and foam for furniture , providing mainly to the local market with some exports to Uruguay (less than 10%).

The following table shows the production equipment.

PLANT	EQUIPMENT	OUTPUT	YEAR
Buenos Aires	MAX FOAM, PAMPERO	250 KG/MIN	1980
	VERTIFOAM for round blocks	50 KG/MIN	1987
San Luis	VERTIFOAM ZACO	50 KG/MIN	1987

The two companies have partially reduced their CFC use, replacing it by methylene chloride, but taking into account the above-mentioned restrictions in Argentina about the use of this material this process has stopped. The following table shows the CFC consumption during the last years:

YEAR	PRODUCTION Ton/year	CFC-11 Ton/year	Methylene Chloride Ton/year
1992	2,600	112	16.6
1993	2,930	128.5	18.4
1994	3,120	119.2	36.8

5. TECHNOLOGY SELECTION CRITERIA AND IMPACT

5.1. Overview and Selection

There are several options to replace CFCs in the manufacture of flexible polyurethane slabstock. They are described and reviewed in the Multilateral Fund's document UNEP/OZ L.Pro/Ex.Com./16/Inf3: Flexible Polyurethane foams options to reduce/eliminate the use of CFCs. The use of methylene chloride is one of them, but the Argentine Government does not accept this option, because:

a) during foaming process the M.C. concentration in exhaust gases are higher than allowed as per pertinent federal regulations.

b) in the future this substance will be submitted to even stricter controls and regulations on that are currently being drafted.

Methylene Chloride is therefore not feasible as a replacement technology for CFC-11 in the argentine flexible foam sector, but it could be allowed for a restricted interim period, in those projects where transition periods are needed to adjust all the formulations. Such is the case of all water system plus accelerated cooling process plus additives, as well as for the "low index technology".

Besides, both companies produce a lot of different slabstock densities and qualities, and the use of methylene chloride in some of them causes severe scorching.

To phase out CFC-11 consumption SUEÑO ESTELAR S.A. and ESTELAR SAN LUIS have decided to replace CFC-11 by water, using a forced cooling system to dissipate excess process energy originating from the water/TDI reaction and the use of additives to achieve the required softness.

5.2. Impact on Production Process.

The installation of a forced cooling system (FC) will reduce the need for curing space, but will increase the required space in the production area to allocate this system. A backup generator has to be installed to avoid fire risk in case of a power outing.
The technology requires additional systems for polyol and additives.

Fire fighting equipment has to be adjusted to the new lay out. Safety and production training is required following installation, prior and during start-up. The start-up will be supervised by UNDP experts.

5.3. Description of the Proposed Reconversion

Under this project, the two plants will phase out the use of CFC's in the manufacture of flexible slabstock foam by the use of all-water-blown technology.

Maintaining present facilities, the following is required:

* provision and installation of a FC system
* provision and installation of additive system and the corresponding polyol system
* a back up generator
* improvement of the fire fighting system

6. PROJECT COSTS

6.1. Capital Costs

The following is a summary of the expected costs of investments and related activity, including equipment, training, testing, and technology transfer:

Item	Buenos Aires	San Luís
Accelerated cooling system	350,000	75,000
Additive system	20,000	5,000
Polyol system	50,000	15,000
Emergency Power Generator	30,000	20,000
Fire fighting	10,000	10,000
Start-up / Trial materials	10,000	5,000
Technology Transfer	10,000	10,000
Contingency	48,000	14,000
Total	528,000	154,000
TOTAL (two plants)	682,000	

6.2. Operating Costs

The introduction of additives combined with the use of all water blown technology will be a comprehensive process and the operating cost after conversion are highly dependent on the final choice of the formulation, which will be determined during process trials.

Annex I provides a consolidation of the effect of the various changes on the operating costs. The incremental operational (NPV) for four years amounts to **US$ 63,000**

6.3. Cost Effectiveness

Item	Units	Value
a) Capital costs	US$	**682,000**
b) Operating Costs / year	US$/year	**19,900**
c) Operating Costs, NPV (four years)	US$	**63,000**
d) ODS Reduction/year	kg	**128,600**
e) Capital recovery factor		**0.16275**

Unit abatement costs (a x e + c)/d	US$/kg/ year	1.02

Cost effectiveness (a + b)/d	US$/kg/ year	5.79

7. PROJECT FINANCING

Sueño Estelar S.A. y Estelar San Luís request the donation of 100% of the project costs, reflecting the 100 % local ownership, amounting to: **US$ 745,000**

8. PROJECT TIMETABLE

Activity	Trim 1	Trim 2	Trim 3	Trim 4
1. Preparation:				
License Agreement	x			
Procurement	x			
Vendor Selection	x			
2. Installation:				
Arrival. customs		x x x	x	
Installation			x x x	
Training (safety)				x
3. Start-up:				
Machine Start Up				x x
Trials				x
Training (in process)				x x
Certification				x

9. REGULATORY ACTION

This project will not require regulatory actions.

10. PROJECT IMPACT

This project will eliminate the use of, at least, 128,6 tons oi CFC-11 in the first year of implementation. The projects uses commercially and environmentally acceptable technology .

ANNEX I - Incremental Operational Costs

Before:	128.6 t. CFC-11	US$ 2.4	US$ 308,640
After:	128.6 t. TDI	US$ 2.1	US$ 270,060
	6.7 t . softener	US$ 7.5	US$ 50,763
	More energy (77,000 kw)	US$ 0.1	US$ 7,700
	Total		US$ 328,523
Incremental operating costs per year		US$ 19,883	
NPV, 4 years, 10% per year		US$ 63,011	

Note 1: The introduction of special polyol will reduce the use of the additive. The net financial impact is thought to be about neutral.

Note 2: The additional TDI needed, reacts with water, which replaces CFC with an approximate 1:1 ratio.

ANNEX II: COMPARISON BETWEEN EXISTING AND REQUIRED EQUIPMENT.

CFC-11	WATER BLOWN TECHNOLOGY
Foaming unit: - MAX FOAM, PAMPERO output 250 kg/ min, year 1980 PLANTA BUENOS AIRES	Same foaming unit. Incorporation of additive and other polyol systems.
Foaming unit: VERTIFOAM for round blocks 50 kg/min, year 1987 PLANTA BUENOS AIRES	Same foaming unit. Incorporation of additive and other polyol systems.
Foaming unit: VERTIFOAM, ZACO, output 50 kg/min, year 1987 PLANTA SAN LUÍS	Same foaming unit. Incorporation of additive and other polyol systems.
	3 Force cooling tunnels

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TECHNICAL REVIEW.

1.Country:

Argentina.

2.Project Title:

SUEÑO ESTELAR S.A. AND ESTELAR SAN LUIS S.A. CONVERSION to non CFC technology in the manufacture of flexible foam (slabstocks).

3.(Sub)Sector:

Foamed plastics.

4.CP-Relationship:

The CP for the Argentine Government for the ozone layer protection was approved at the 13th Executive Committee Meeting of the MLF of the Montreal Protocol.It contained the intention of the Gouvernment and Industry to phase out the use of ODS by 2006 in general, and before 1998 in the non-insulating foams.

5.Technology:

The technology to substitute CFC11 with water, and additional foreced cooling, in the production of flexible slabstock PUF, is fully acceptable. It has been developed in the US and is particularly suitable for foams with a thin skin (as it is eg the case in the Vertifoam process).
Compared to the methylenechloride process, this technology will generate higher chemical costs (different polyol and softening agents) but provides space savings.
The fire risk is slightly increased.
It is suggested that ESTELAR considers whether the CarDio process is not mature enough to be considered seriously.

6.Environmental Impact:

CFC11 is replaced by water, generating carbondioxide.
The GWP of CO_2 is only 0.025 % of the GWP of CFC11.

7.Project Costs:

The costs represented in he project can be accepted, but it is unclear why the existing polyol equipment cannot be used for the new project. If it were the case, the costs could be reduced by USD 35,000 in each plant.
It must be checked whether local firms cannot provide a forced cooling system for a lower price (eg + USD 250,000 - 300,000)
The incremental operational costs are not requested by the company.

8. Implementation:

Can be accepted as proposed.

9. Recommendation:

It is recommended to check whether the costs can be reduced by USD 70,000 by using the existing polyol equipment.
It is further proposed to look for other possible cost reductions as mentioned in chapter 7 of this review.
Hereafter it is recommended to accept the project.

Prepared by Hubert Creyf, UNDP Foam Sector Reviewer.
Date:060395.

After discussion with Mr B. Veenendaal, Foam Sector Expert, the raised technical questions were solved, and project costs were agreed upon.
It is hence recommended to accept the project.

Hubert Creyf, Foam Sector Technical Reviewer.
Date, 061195.

PROJECT COVER SHEET

Country:	ARGENTINA
Project Title:	SISTEMAIRE S.A. -- Conversion to non-CFC technology in the production of mobile air conditioning systems
Sector Covered:	Mobile Air Conditioning
ODS used in Sector:	627 tons CFCs (ODP)
Project Impact:	60 tons CFC-12/year
Project Duration:	One (1) year
Project Economic Life:	Ten (10) years
Total Project Costs:	US$ 3.939.973 Incremental Capital Cost
Intermediary Fee:	US$ 118.199
Proposed ODS Grant:	US$ 4.058.172
Unit abatement cost:	US$ 10,69/year (indirect unit abatement cost, for capital costs)
National Coordinating Body:	OPROZ -- INTI
Implementing Agency:	WORLD BANK
Beneficiary Enterprise:	SISTEMAIRE S.A.
Appraisal Date:	December, 1994

PROJECT SUMMARY

Under this project, SISTEMAIRE S.A. will convert the present production of CFC-12 mobile air conditioning units (MAC) to HFC-134a compatible technologies, including heat exchangers (condenser and evaporator) and hose fittings line. This project includes the redesign and retooling of production lines, training and technical assistance. The SISTEMAIRE project proposal representing 25% of the MACs market in Argentina will result in conversion of the whole MACs production sector in Argentina.

1. GENERAL BACKGROUND

The Country Program of the Argentine Government for the protection of the ozone layer was presented and approved in the XIII Executive Committee Meeting of the Multilateral Fund of the Montreal Protocol. This Country Program contains the intention of the Government and the industry to reduce and phase out the consumption of ozone depleting substances (ODS).

This country program calls for a total phase-out of ODSs by the year 2006, and reductions in advance of the scheduled date established by the Montreal Protocol and its amendments. Reasons for such a policy are environmental impact and future international restrictions to the products that contain these substances.

ODS consumption in Argentina during year 1992, the base year of the country program, was 1,338 tons of CFC-11 and 2,408 tons of CFC-12. Due to the growth of sectors that use ODSs, consumption has increased approximately 7% during 1993 and 6% during 1994.

2. OBJECTIVE

The objective of this project is to convert the present SISTEMAIRE S.A. production of CFC-12 air conditioning units, including evaporator, condensers, hoses, fittings and assembly lines to HFC-134a compatible technologies. Redesign and retooling of the present production lines are required. Retooling is required to conform to SAE/ESO standards for HFC-134a. Service is not part of this project because MACs service shops are not part of SISTEMAIRE. All issues related to servicing will be covered by the already approved cooperation project with the United States Environmental Protection Agency (USEPA).

3. SECTOR BACKGROUND

In 1993 the Argentine automobile industry produced 300.000 vehicles. This production has greatly increased during the present year, and taking into account the production programs of the domestic auto manufacturers CIADEA (Renault), SEVEL (Fiat, Peugeot) and Autolatina Argentina (Ford and Volkswagen), the 1994 automobile production reached 400.000 units.

45% to 50% of new vehicles have installed air conditioning units. In addition, there is an interesting market for mobile air conditioning units, since around 10% of the no more than one year old cars install air conditioning units during this first year.

Taking into account these figures, and considering that the average charge is 1 kg per unit, present CFC-12 consumption is around **200 tons per year for new equipment.**

Around 1.700.000 vehicles have air conditioning. Assuming that each 3 to 4 years these units are recharged and that each service consumes 0.8 kg, **427 ton per year are consumed for servicing. Assuming that the units require recharging during servicing on an annual basis, this consumption may be much higher. Some experts believe that servicing frequency may be much higher in developing countries. The United States EPA (USEPA) and the Government of Argentina (GOA) have agreed to develop a recovery and recycling program aimed specifically at this part of the MACs sector. The management of issues related to CFC-12 MACs in the older generation of automobiles was included in the scope of the program.**

The production structure of this sector is based upon 4 companies as follows:

INTERCLIMA:

Produces condenser and evaporators for MIRGOR S.A and also for VALEO Brazil.

CACHAN:

Produces radiators and condensers. The major part of its condenser production is for MIRGOR S.A.

MIRGOR:

Provides complete systems to the domestic auto manufacturers. Produces hoses for the systems, assembles condensers and evaporators provided by CACHAN and INTERCLIMA and imports the compressors. Its customers are CIADEA (Renault) and SEVEL (Fiat y Peugeot). Units provided represent around the 75% of the domestic market.

SISTEMAIRE:

Provides complete systems to the domestic auto manufacturer AUTOLATINA Argentina. It produces condensers, evaporators, hoses and fittings. It shares 25% of the finished mobile air conditioning (MACs) market.

The country program calls for the phase-out of CFCs in the mobile air conditioning sector on or before 2000 for new equipment, while CFC consumption for servicing is scheduled to be phased-out on or before the year 2004. Pending additional research, a final strategy will be decided upon to either service with CFC-12 or to retrofit CFC units to HFC-134a.

The sector strategy is as follows:

a) Three integrated projects, MIRGOR, INTERCLIMA and CACHAN, presented and approved by the XV Meeting of the parties, that means 75% of the MAC sector consumption for new equipment.

b) One project to convert the heat exchanger and hoses and fittings production and the assembly line by SISTEMAIRE, that means 25% of the MAC sector consumption for new equipment.

c) One project for recovery and recycling of CFC-12 and training for service activities. A bilateral cooperation project with USEPA, covering this subsector, was approved at the XVI Meeting of the Executive Committee of the Multilateral Fund of the Montreal Protocol (MFMP).

The ODS consumption in the sector would be phased out according to the following:

Total ODS consumption:	627 ton
Estimated ODS consumption to be phased down through:	
Mirgor, Cachan and Interclima projects already approved	180 ton
Sistemaire	60 ton
Recycling, recovering and training for service - USEPA	350 ton
*Small companies (i.e.: After market installation for buses, to be included in the above project)	37 ton

* The USEPA program includes a pilot project to recommend CFC reduction options for the small companies of the MACs sector. It is acknowledged that 37 tons is not significant relative to the rest of the sector, but that appropriate measures will be included.

With the approval of the SISTEMAIRE project, Argentina will convert practically the entire MACs sector.

4. ENTERPRISE BACKGROUND

SISTEMAIRE produces heat exchangers, evaporators, condensers, heaters, and hose fittings and also assembles all components for the automobile air conditioning units. Annual sales of US$ 30.100.000 were reported during 1994. SISTEMAIRE has two MACs production facilities: one in Rio Grande, Tierra del Fuego, where MAC units are produced and the another one in Buenos Aires, where assembly of MAC units and heaters takes place. The company has 488 employees. Additional data are the following:

Capacity Production:	**80.000 finished MAC units per year**
	100.000 evaporators per year
	100.000 condensers per year
	120.000 fittings per year
1994 Production:	**44.000 finished MAC units per year**
	23.000 evaporators per year
	13.000 condensers per year
	40.000 fittings per year
Annual CFC consumption:	**60 Ton (indirect)**
Market share:	**25 % of the domestic market**
Other markets:	**Brazil (MERCOSUR Agreement)**
Ownership:	**100% Argentine**
Technology sources:	**Evaporators and condensers: SIGNET SYSTEM INC U.S.A.**
	Fittings: SAE/ESO Standard

5. TECHNOLOGY : Overview and Selection

Presently the only alternative, commercially accepted to replace CFC-12 is the HFC-134a refrigerant. This refrigerant is being widely introduced in mobile air conditioning application in Europe, Japan and USA.

As a consequence of the different characteristics of the HFC-134a refrigerant molecule, there is a need for complete retooling in order to go to HFC-134a.

SISTEMAIRE presently produces tube and fin condensers for MAC systems. This current tube and fin design will not have adequate capacity required for HFC-134a. Therefore, this project includes a component to manufacture parallel flow condensers with adequate capacity for HFC-134a.

For corporate reasons, as can be seen in Annex 1, the company will also have to produce serpentine design condensers. Sistemaire is not requesting MFEC funding for the serpentine condensers, which will be financed by Sistemaire itself.

In addition to the parallel flow type condenser technology for which funding is being requested in the project, financing from the MFEC will be requested for 50% of the evaporator line conversion costs.

For evaporators, it is has been determined that the actual Tube and Fin design does not require changing. However, the original manufacturers involved with SISTEMAIRE require the use of aluminum material in place of copper tubes. The Government of Argentina (GOA) has communicated its concern to the Multilateral Fund of the Montreal Protocol (MFMP) and its opinion on the subject. In addition the project was initiated and has been in progress for over 2 years.

The technology changes included in this project were already approved by the XV Meeting of the Executive Committee of the MFMP for the INTERCLIMA and CACHAN projects.

Different chemical structure associated with HFC-134a makes it necessary to adopt new hoses, desiccants, and new gaskets in order to meet international specifications and standards (ESO/SAE). So assembly lines have to be converted and testing on the new components is necessary, and the hose fitting line has to be retooled in order to manage new materials and new diameters.

Introduction of the new designs in the system will require unit redesign. The same occurs with the compressor and expansion valves that have to be changed.

Present production and required technology changes are given by model and customer in Annex I. The figures in Annex I are based upon the planned production of the MERCOSUR automobile manufacturers.

6. DESCRIPTION OF THE PRESENT PRODUCTION LINES AND THE PROPOSED CONVERSION.

6.1 Heat Exchangers

6.1.1 Current Production Evaporators and Condensers (Rio Grande Plant)

Presently SISTEMAIRE produces evaporators and condensers with the tube and fin technology, using copper tubes and aluminum plate fins.

The machines used are:

– MACHINERY	– CONVERSION POSSIBILITIES WITH THE NEW TECHNOLOGIES
– Fin press Burr Oak Fp-1	– Yes, with tooling, Annex V, Evaporators, item 1.
– Straightening, cutting and bending machine Burr Oak (Hairpin Bender)	– Yes, with tooling Annex V, Evaporators, item 2.
– Straightening and cutting machine Burr Oak	– Yes, for evaporators without any modification
– Vertical expander Burr Oak	– Yes, with tooling, Annex V, Evaporators, item 3.
– Vapor degreaser (1.1.1 Trichloroethane)	– No, it must be replaced by item 1, Table II, Annex IV.
– Hand torch brazing line	– No, it must be replaced by system items 2 to 7, Table II, Annex IV.
– Pressure decay leak test (SEE ANNEX MCK)	– Yes, for evaporators, without any modification
– Hand benders	– Yes, for evaporators, without any modification
– Brazing fixtures	– No.
– Charging machine for CFC- 12	– No, it must be replaced by item 8, Table II, Annex IV
– Leak test for CFC-12	– No, the halogen leak test machine only works on R-12. To meet ESO/SAE standards it must be replaced by item 9, Table II, Annex IV.

See the corresponding flow chart in Annex II part I,

6.1.2 Proposed production - Evaporators (Rio Grande Plant)

Sistemaire plans to produce all aluminum tube and fin evaporators to be used with HFC-134a in the present plant of Rio Grande. See Section 5, page 4 for rationale.

The production process is similar to the actual production of copper tubes and aluminum fins, requiring similar machines and other tooling. The principal difference is the brazing of the tubes. The present brazing system is not appropriate for aluminum brazing. A continuous brazing machine with torches and then a washing machine to clean the inside and outside of the piece to remove the flux residue is needed, since the present vapor degreaser uses 1,1,1-trichloroethane, which depletes the ozone layer. A new system which uses an alkaline aqueous solution is therefore proposed.

Due to the toxicity of the waste generated during the washing process, it is necessary to treat the effluents appropriately.

The leak test will be performed by pressurizing with R-134a and N_2 and using an INFICON halogen detector for HFC-134a.

A flow chart of the proposed production is given in Annex III, part III.

Machines and tooling needed for the production of these evaporators are listed in annex IV, table II and annex V.

6.1.3 Proposed production - Condensers (Bs As. Plant)

The change to HFC-134a requires additional surface, which is impossible to obtain within the available tight vehicle space with the present tube and fin technology. For this reason, Sistemaire is faced with the corporate decision to manufacture both serpentine and parallel flow technologies, with aluminum tubes.

- The technology to be requested from the Multilateral Fund is the parallel flow Nocolok process used widely over the world. In the case that Sistemaire were requested to provide serpentine design, the additional tooling and equipment costs will be assumed by Sistemaire.
- Flow charts of the proposed production lines are given in Annex III, part I.
- Machines and tooling needed for the production of these condensers are listed in annex IV.- table I and annex V.

6.2 Hose fittings

6.2.1 Current Production (Bs. As. Plant)

SISTEMAIRE produces aluminum fittings for the traditional all rubber hoses, beginning with a thick walled tube, machining both ends to make the racord for crimping the hose and reducing the wall thickness to make the o-ring bed with a press operation. Retooling of the hose fittings is required due to ESO/SAE standards.

After bending and degreasing, a heat treatment is made to increase the hardness. A flow chart of the current production is given in Annex II, part II.

6.2.2 Proposed production (Bs. As. Plant)

For the new types of barrier hoses to be used with HFC-134a, SISTEMAIRE plans to produce fittings made of aluminum tube, with the racord formed by a cold rolled process (without machining).

Both ends will be formed by cold formed process, and the ferrule will be fixed by a double bed lock.

The bending, degreasing and heat treatment processes will be similar to the actual ones.
Flow chart of the proposed production line is given in Annex III, part II.

Machines and tooling needed for the production of these fittings are listed in annex IV.- table III and annex V.

7. PROJECT COSTS

7.1 Capital Costs

Capital incremental costs include tooling and shipping expenses, technical assistance and training. Detailed cost breakdown is given in annex IV, V and VI.

EQUIPMENT	US$
1. Heat exchangers line	3.038.794
2. Fitting, hose and assembly line	378.000
3. Technology transfer: License agreement Technical assistance	 75.000 25.000
5. Training	58.000
6. Test and trials:	7.000
7. Contingencies 10%	358.179
TOTAL COSTS	3.939.973

It is recognized that this does not cover all hazards. The new installation will require much higher operational and maintenance practices.

7.2 Incremental Operational Cost.

Incremental operational costs produced by an increase in price of compressor, expansion valve and dryer and hoses are partially offset by the lower cost of aluminum compared with that of copper. The company has chosen not to request funding for incremental operational costs because of the improved integrity of the system.

7.3 Unit Abatement Cost.

CFC consumers in the mobile air conditioning sector are automobile manufacturers which are not MAC system producers. In order to estimate the unit abatement cost, an indirect CFC consumption was assumed based on the total number of units manufactured in the domestic market and a conservative estimate of service consumption for one year old units. If the UAC estimate includes units over one year (i.e., 3 or 4), a less conservative UAC estimate can be made which improves cost effectiveness.

Item		Units	Value
a)	Capital costs	US$	**3.939.973**
b)	Project Useful Life	years	10
d)	ODS Reduction/year	kg	60.000
e)	Capital Recovery factor (10 % discount rate)		0,16275
Unit Abatement Cost [a(e) /d] - Capital Costs.		**US$/kg/year**	**10,69**

8. PROJECT FINANCING

SISTEMAIRE requests MFMP Grant funding for the project costs, reflecting 100% of local ownership, calculated on **US$ 3.939.973,** but acknowledges that the Grant amount may be reduced as in previous projects already approved by the Executive Committee of the Multilateral Fund.

9. PROJECT EXECUTION

9.1 Responsibilities

SISTEMAIRE S.A will coordinate with OPROZ the terms for all required responsibility agreements, including a description of accountability, and explicit arrangements to receive technical or managerial assistance from both federal institutions (as INTI) and/or private, domestic or foreign parties, from either international organizations (as World Bank) or from the private sector, mainly in association with equipment/raw-material suppliers.

OPROZ and INTI will oversee the successful implementation of the project. As part of their supervisory role, they will ensure the proper disposition of the CFC-12 equipment. Equipment which can not be retooled for use in the non-ODS facility will be destroyed.

9.2 Project Schedule

The new assembly line will be ready 18 months after the beginning of the project. Development of components to start production is estimated at 4 months (including testing approval by customers).

10. REGULATORY ACTION

This project will not require regulatory actions.

11. PROJECT IMPACT

This project will contribute to eliminate the use of, at least, 60 tons of CFC-12 in the first year of implementation and the use of 1,1,1-trichloroethane. The projects employ commercially and environmentally acceptable technology and will thus be instrumental in the subsequent elimination of the use of CFCs in similar plants in Argentina.

IMPLEMENTATION SCHEDULE

	MONTH																						
DESCRIPTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Project definitions	■																						
Machinery & equipment definitions	■	■	■																				
Design of complementary services			■	■																			
Tooling design			■	■																			
Equipment procurement			■	■	■																		
Tooling procurement			■	■	■																		
Services procurement			■	■	■																		
Plant engineering definitions				■	■	■																	
Equipment delivery time						■	■	■	■	■	■												
Equipment mounting												■	■	■									
Comp. services mounting														■	■	■							
Start up of equipments																■							
Try out																	■						
Pilot run																		■					
Start of production																			■	■	■	■	■

ANNEX I
REQUESTED CUSTOMER DESIGN TECHNOLOGY BY VEHICLE MODEL
DESIGN CHANGE TYPE & COMPONENTS APPLICATION

MARKET	CUSTOMER	MODEL	CHANGE TYPE			UNITS/YEAR			APPLICATION		
			1	2	3	1994	1995	1996	C	E	F
Domestic	Ford	Orion	X			9000	20000	22000	X	X	X
		Light Truck F-Series	X			–	10000	10000	–	–	X
		Escort old*/new			X	10000*	New	12000	X	X	X
	VW	Gol	X			13000	28000	28000	X	–	X
		Pointer	X			–	15000	15000	X	X	X
	Toyota	Hi-Lux		X		–	–	2000	X	–	X
	G.M.A.	C-10, C-20 D-20		X		–	–	1000	–	–	X
	CIADEA	Clio (Renault		X		–	–	8000	X	X	X
	Mercedes Benz	T 1 N			X	–	–	2000	X	X	X
Export	VW Brasil	Pointer-Logus	X			6000	7000	7000	X	X	–
	Ford Brasil	Escort-Verona	X			6000	7000	7000	X	X	–
		Fiesta			X	–	–	5000	X	–	X

X Parallel flow

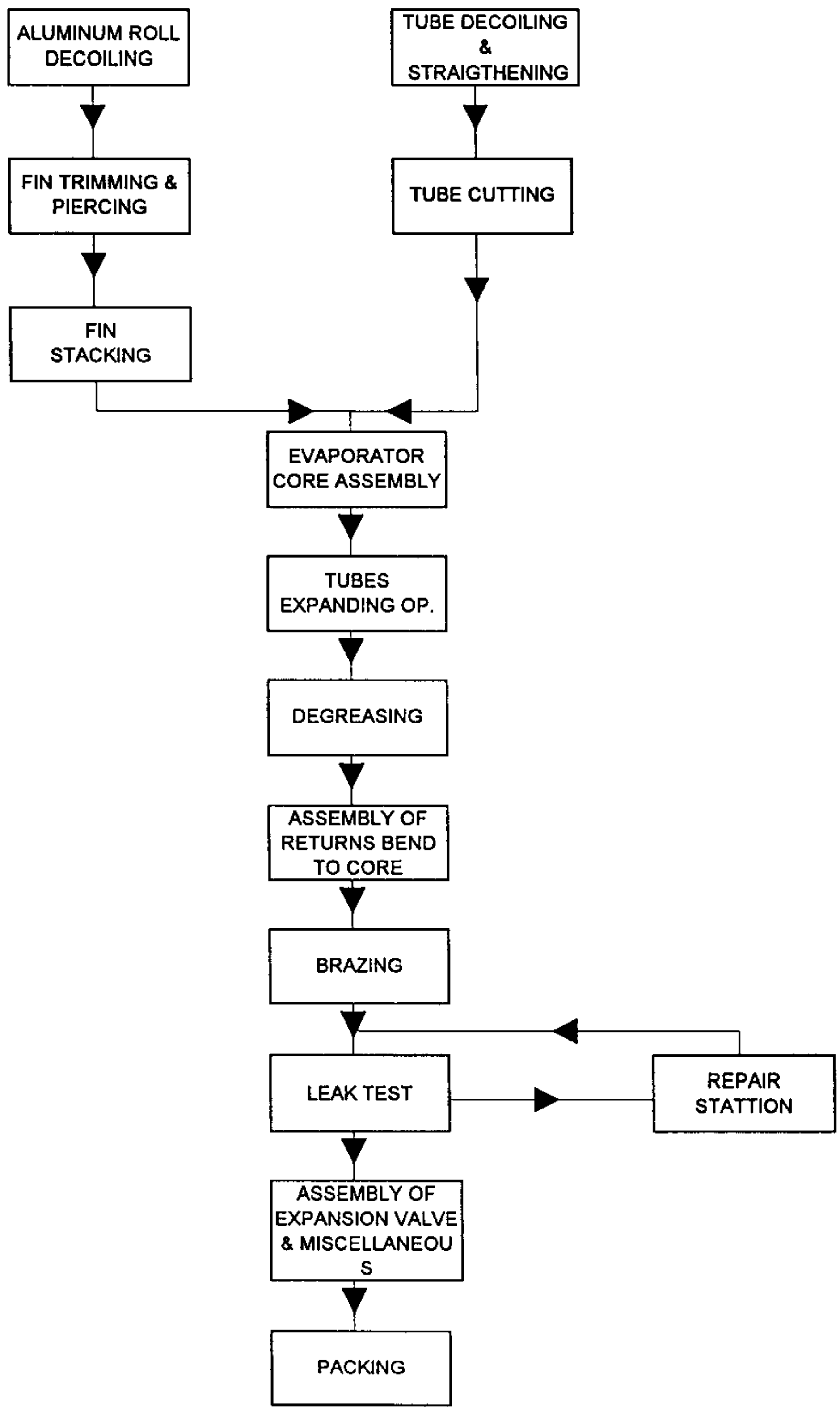
Type 1 - Models with units redesigned for HFC-134a
Type 2 - Request for units already designed for HFC-134a
Type 3 - Potential business

APPLICATION
C - Condenser (Parallel flow type)*
E - Evaporator (Tube & Fin)**
F - Fittings (Aluminum fittings for barrier hose)

*All costs associated with the serpentine designs will be assumed by Sistemaire.
** The MFEC will be requested to finance 50% of the evaporator line conversion.

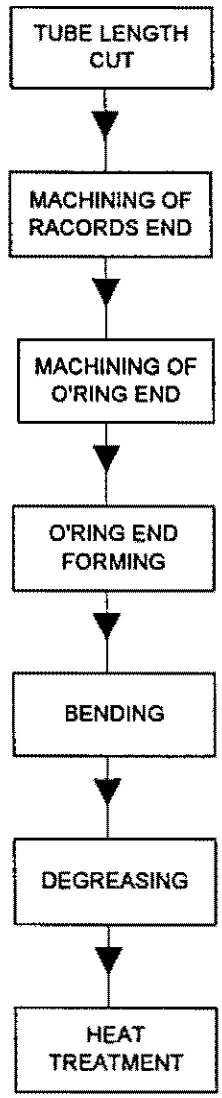
ANNEX II - PART I
PROCESS FLOW CHART
CURRENT PROCESS

TUBE & FIN EVAPORATOR & CONDENSER CORE



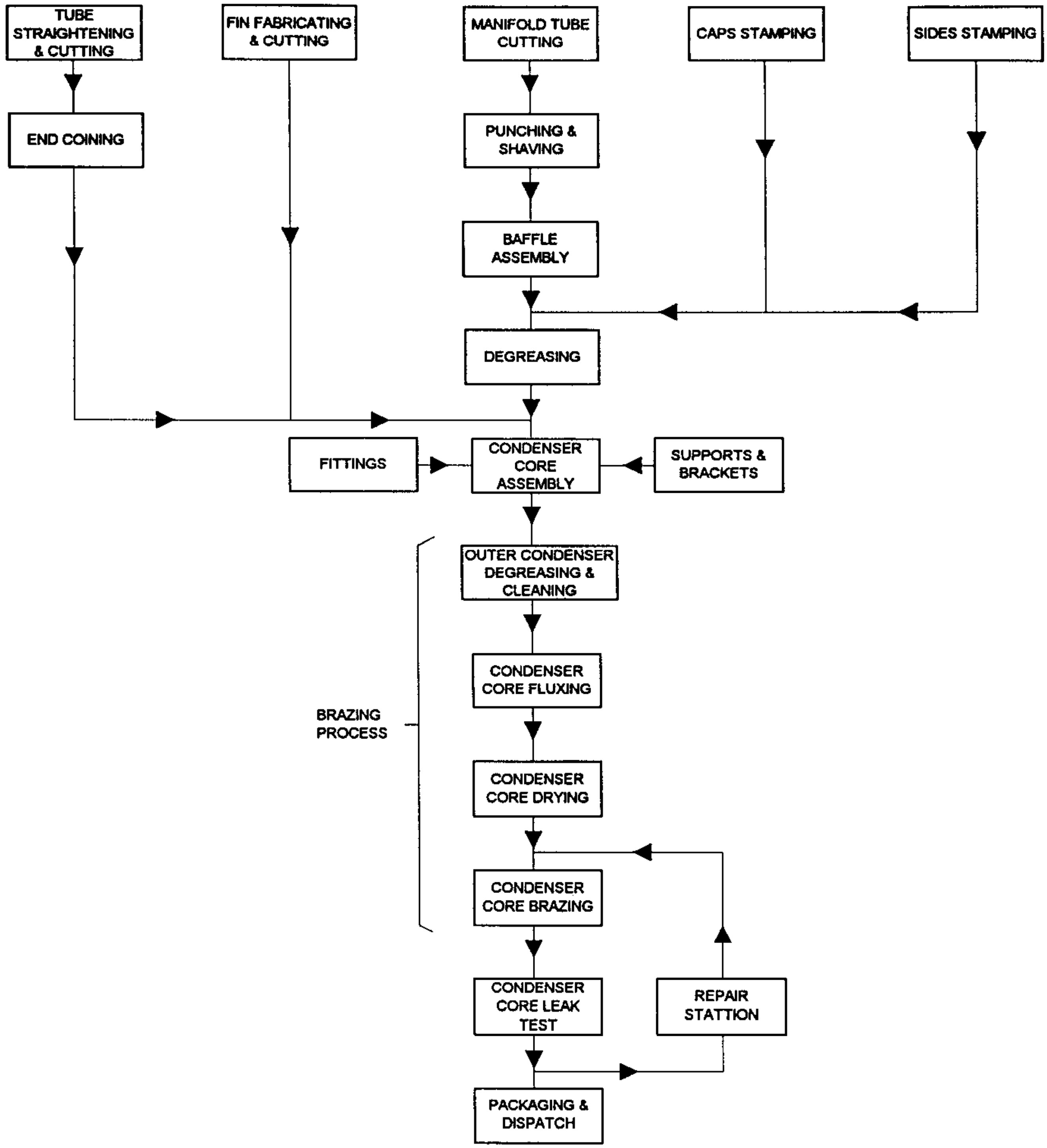
ANNEX II PART II
PROCESS FLOW CHART
CURRENT PRODUCTION

HOSE FITTINGS



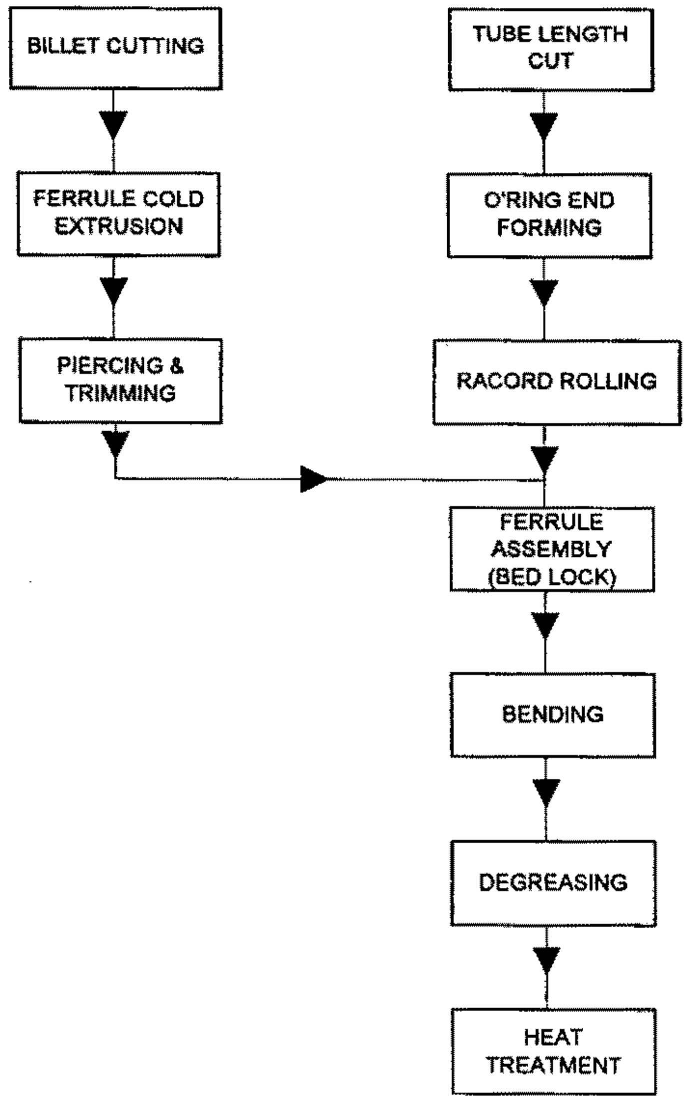
ANNEX III PART I
PROCESS FLOW CHART
PROPOSED PRODUCTION

PARALELL FLOW CONDENSER CORE



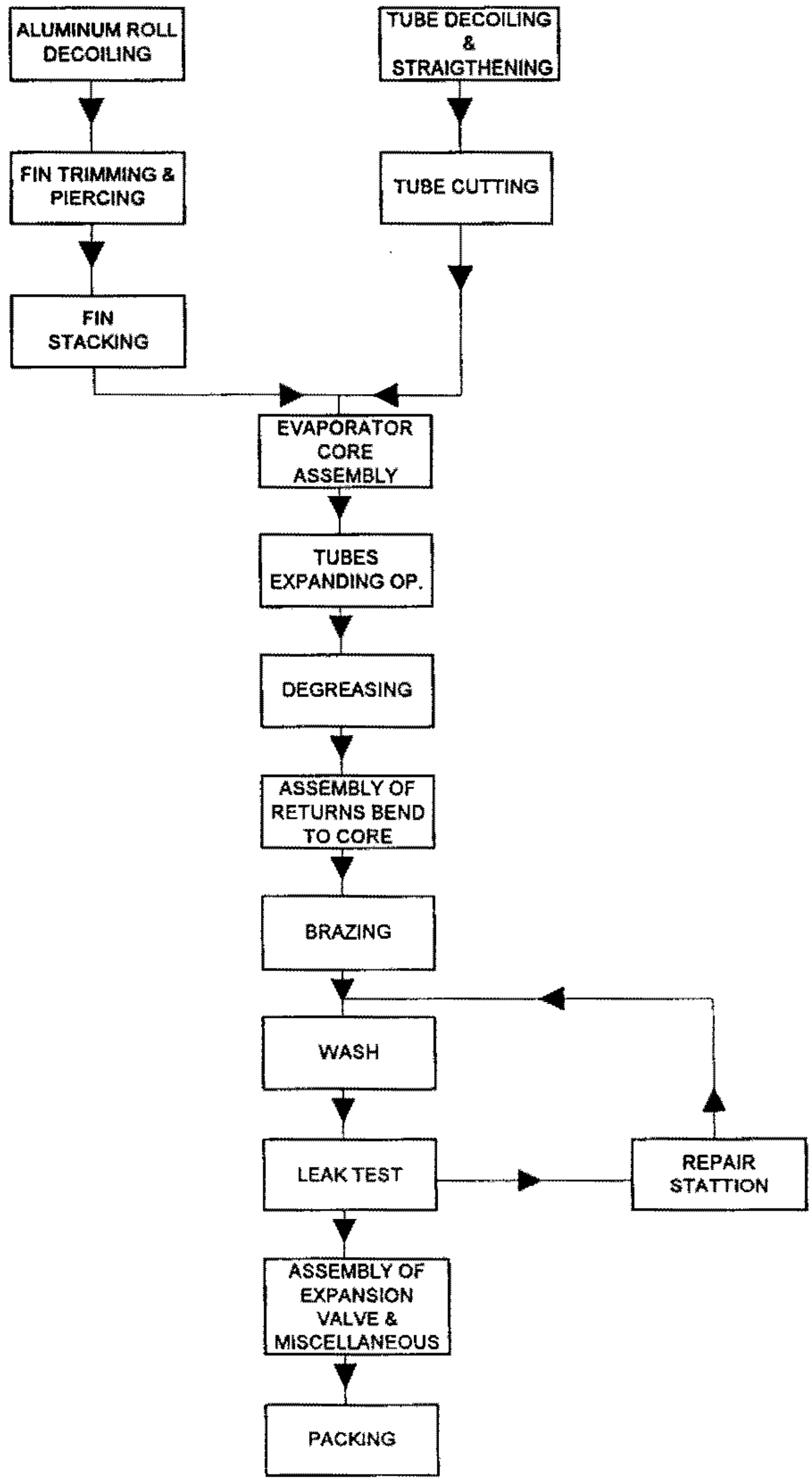
ANNEX III PART II
PROCESS FLOW CHART
PROPOSED PRODUCTION

HOSE FITTINGS



ANNEX III - PART III
PROCESS FLOW CHART
PROPOSED PROCESS

TUBE & FIN EVAPORATOR (ALL ALUMINUM)



- ANNEX IV TABLE I -
EQUIPMENT COST BREAKDOWN (CONDENSERS)

IT	DESCRIPTION	TOTAL COST - U$S	
		NATIONAL	IMPORTED
	FOR PARALLEL FLOW CONDENSERS		
1	Corrugated fin machine		190000
2	Fin traying unit		127000
3	Tube uncoil - straightening unit		15000
4	Extrusion saw		46070
5	Straightening, cutting, and sizing machine		220000
6	Manifold former		90000
7	Baffle positioner		45000
8	Core assembly machine		250000
9	90 degree dog leg bender		19000
10	Coining and slotting machine		127740
11	Core water washing machine	105000	37750
12	Secondary two pass condenser bender		57910
13	Presure decay leak test system		
14	Continuous fluxer		511360
15	Continuous dry off oven		
16	Nocolok continuous brazing furnace (34 cores/h)	32000	
17	Demineralized water unit		
18	Pretreatment unit	150000	
19	Paint hood		
20	Dry oven		
	TOTAL	287000	1736830

- ANNEX IV TABLE II -
EQUIPMENT COST BREAKDOWN (EVAPORATOR)*

IT	DESCRIPTION	TOTAL COST - U$S	
		NATIONAL	IMPORTED
1	Degreaser		150000
2	Braze oven (Torches with conveyor)		200000
3	Flux dispensing equipment		3000
4	Internal wash		6000
5	External wash / oven		125000
6	Conveyor	6000	
7	Waste treatment		200000
8	Refrigerant charge / reclaim		10000
9	Refrigerant leak detector (134a)		5000
	TOTAL	6000	699000

*The MFEC will be requested to finance 50% of the evaporator line conversion ($705,000 * 0.5 = $352,500)

- ANNEX IV TABLE III -
EQUIPMENT COST BREAKDOWN (FITTINGS)

IT	DESCRIPTION	TOTAL COST - U$S	
		NATIONAL	IMPORTED
1	Tube end forming machine (Manchester) (O' ring end).		35000
2	Tube end forming machine (Manchester) (Crimp end).		35000
3	Roll forming machine	30000	
4	Programed tube bender		110000
5	Induction brazing unit		100000
	TOTAL	30000	280000

- ANNEX V -
TOOLING COST BREAKDOWN

IT	DESCRIPTION	TOTAL COST - U$S	
		NATIONAL	IMPORTED
	FOR CONDENSERS		
1	Corrugated fin tooling 13 mm.		9612
2	Corrugated fin tooling 15.5 mm.		9600
	TOTAL		19212
	FOR EVAPORATORS*		
1	Find Die		120000
2	Hair pin tooling		15000
3	Expander tooling		25000
	TOTAL		160000
	FITTINGS & HOSE		
1	Die for extruded ferrule (5/16", 13/22", 1/2", 5/8")	40000	
2	Crimp die (5/16", 13/32", 1/2", 5/8")	14000	
	TOTAL	54000	

*The MFEC will be requested to finance 50% of the evaporator line conversion ($160,000 * 0.5 = $80,000)

ANNEX VI
EQUIPMENT & TOOLING COST SUMMARY

IT.	DESCRIPTION	TOTAL COST - U$S	
		NATIONAL	IMPORTED
	HEAT EXCHANGERS LINE		
	Equipments		
	Condensers	287000	1736830
	Evaporators*	6000	699000
	Toolings		
	Condensers		19212
	Evaporators*		160000
		293000	2615042
	5 % TO CIF		130752
			2745794
	TOTAL HEAT EXCH. LINE	3038794	
	FITTINGS LINE		
	Equipments	30000	280000
	Toolings	54000	
	5 % to cif		14000
		84000	294000
	TOTAL FITTINGS LINE	378000	

*The MFEC will be requested to finance 50% of the evaporator line conversion ($865,000 * 0.5 = $432,500)

ANNEX VII
TRAINING

IT	DESCRIPTION	TOTAL COST - U$S
	EVAPORATORS*	
1	1 Engineer during 2 week (In Signet System Inc. U.S.A.)	8000
2	2 Technician during 2 week (in Signet System Inc U.S.A.)	14000
	CONDENSERS	
1	1 Engineer during 2 week (supplier of machines for parallel flow)	8000
2	2 Technician during 2 week (supplier of machines for parallel flow)	14000
3	2 Technician during 2 week (supplier of brazing furnace)	14000
	TOTAL	58000

*The MFEC will be requested to finance 50% of the evaporator line conversion ($22,000 * 0.5 = $11,000)

ANNEX VIII
TEST & TRIALS

IT	DESCRIPTION	TOTAL COST - U$S
	EVAPORATORS	
1	50 Pcs. model 1 at 20 U$S e/o	1000
2	50 Pcs. model 2 at 20 U$S	1000
	CONDENSERS	
1	50 Pcs. paralell flow 1 at 50 U$S	2500
2	50 Pcs. paralell flow 2 at 50 U$S	2500
	TOTAL	**7000**

ANNEX IX

OORG REVIEWS

COUNTRY OF ORIGIN: ARGENTINA

PROJECT TITLE: SISTEMAIRE S.A. · CONVERSION TO NON CFC TECHNOLOGY IN THE PRODUCTION OF MOBILE AIRCONDITIONING SYSTEMS

IMPLEMENTING ORGANIZATION: SISTEMAIRE S. A.

SECTOR: MOBILE AIR CONDITIONING

RELATIONSHIP TO THE COUNTRY PROGRAM:

This project proposal appears to be a compatible part of a total program focused at the elimination of the use of CFC-12 refrigerant.

TECHNOLOGY:

The technology uses HFC-134a as a refrigerant, which is considered the lowest technical risk and the most environmentally sound replacement available. The standards and specifications have been established and published by recognized international technical associations. This proposal incorporates appropriate international standards and recommended practices.

The need to convert the evaporator primary surface from copper to aluminum when using HFC 134a as a refrigerant has not been confirmed, and is not currently considered essential.

The proposal recognizes the need to pursue the conversion to HFC-134a into the sub suppliers and service arena.

ENVIRONMENTAL IMPACT:

The reductions in CFC emissions projected in the proposal are reasonably attainable. The proposal includes elimination of trichloroethane vapor degreasing and alkaline effluent treatment.

PROJECT COSTS:

Costs associated with the conversion of evaporators from copper to aluminum are not within the current OORG guidelines. (Report 11, January 1995). The conversion was begun before technology confirmed the evaporator material change was not required.

The hose assembly costs and the costs to meet international standards and recommended practices for fittings and leak testing appear reasonable.

IMPLEMENTATION TIME FRAME:

The proposed implementation time of eighteen months is considered optimistic .

RECOMMENDATIONS:

This reviewer recommends approval of the proposal.

OORG REVIEWER-------------------------R. H. PROCTOR

DATE OF REVIEW---------------------- 2 June 1995

MONTREAL PROTOCOL

PROJECT COVER SHEET

COUNTRY:	ARGENTINA
PROJECT TITLE:	Elimination of CFCs in domestic refrigerator production plant in AUTOSAL, S.A. in Argentina
SECTOR:	Domestic refrigeration
ODS CONSUMPTION IN SECTOR:	762 tons (1993)
PROJECT IMPACT:	22 tons - 4,5 tons CFC-12 and 17,5 tons CFC-11
PROJECT ECONOMIC LIFE:	10 years
PROJECT TOTAL COST:	US$ 943,690
INTERMEDIARY FEE:	US$ 28,310
PROPOSED GRANT:	US$ 972,000
COST EFFECTIVENESS:	12.43 US$/kg SAO/year (excluding safety costs)
BENEFICIARY:	AUTOSAL S.A.
NATIONAL COORDINATING AGENCY:	Ozone Program Office, National Institute of Industrial Technology
IMPLEMENTING AGENCY:	World Bank

PROJECT SUMMARY

This program will eliminate the use of CFCs in the manufacturing of domestic refrigerators in San Luís plant, located in the Province of San Luís, Republic of Argentina. The CFC-11 used as a foaming agent in the production of insulating foams will be replaced with cyclopentane, and the CFC-12 used in the refrigeration circuit will be replaced with isobutane. It is estimated that 4,5 tons of CFC-12 and 17,5 tons of CFC-11 (22 tons of SAO) will be eliminated per year. The funds required will be used to retrofit the production lines, testing for the new models, personnel training, and incremental operating costs resulting from the conversion for one year.

GOVERNMENT OF ARGENTINA COUNTRY PROGRAM
ELIMINATION OF CFCs IN DOMESTIC REFRIGERATOR
MANUFACTURING PLANT OF AUTOSAL, S.A.

1. BACKGROUND

The Country Program of the Republic of Argentina for the protection of the ozone layer was presented and approved during the XIII meeting of the Executive Committee of the Multilateral Fund of the Montreal Protocol. The Country Program reflects the objectives of the Government and industry to reduce the consumption of substances that deplete the ozone layer.

This Program estimates the total elimination of ODSs for the year 2006, before it is established by the Montreal Protocol and its amendments. The reasons for this policy are the environmental impact of this decision and the restrictions that the global partnership will impose upon the industrial products that contain ODS in their production.

Argentina has consumed during 1992, the base year for the Country Program, 1338 tons of CFC-11 and 2408 tons of CFC-12. Due to the growth in the sectors that use SAO, this consumption has increased by 7% in the year 1993, and it is estimated that it has grown by 6% in 1994. Both substances are produced domestically (600 tons of CFC-11 and 772 tons of CFC-12) and are imported (1048 tons of CFC-11 and 1990 of CFC-12) (base year 1992).

2. DESCRIPTION OF THE PROJECT

2.1 Project objectives

The objective of the project is the rapid and total elimination of the use of chlorofluorocarbonated substances in the manufacturing of domestic refrigerators in the plant of the enterprise Autosal, S.A., located in Villa Mercedes, Province of San Luis, Republic of Argentina. The CFC-11 used as foaming agent will be replaced in the production of polyurethane foams used in insulation with cyclopentane, and the CFC-12 used as refrigerant with isobutane in domestic refrigerators.

2.2 Context of sector and subsectors of the enterprise

In the refrigeration sector, during 1992, 1441 tons of CFC-12 and 333 tons of HCFC-22 were consumed in the refrigeration circuit. This is the sector of largest consumption of ODS.

In the refrigeration sector, 440 tons of CFC-12 are consumed in the domestic sector, of which 190 tons are used in new equipment and 250 tons are used in service operations. With regards to the commercial refrigeration sector, the consumption equals 668 tons of CFC-12 (68 tons for new equipment and 600 tons for service operations) and 333 tons of HCFC-22. The refrigerated transport and fleet consume 333 tons of CFC-12.

With respect to the foams sector, the consumption in 1992 was equal to 1275 tons of CFC-11 and 209 tons of CFC-12 (second user sector), of which 322 tons of CFC-11 were consumed in the manufacturing of insulating foams for domestic refrigerators and 21 tons were consumed in commercial refrigerators.

The production of domestic refrigerators in 1992 was 761,000 units. This figure increased by 7% in 1993 and is still increasing during 1994.

The domestic sector produces refrigerators and freezers. It is composed basically of 22 enterprises, of which 7 cover 72% of the market. Of these 7 enterprises, 2 are foreign capital and the other 5 are of 100% national capital. The principal industries intend to immediately replace the CFCs.

As expressed before, the CFCs are in part produced domestically and in part imported. With respect to compressors, the local industry provides 30% of the market and the remaining 70% is imported mostly from Brazil. The rest of the components are produced locally. The initiation of MERCOSUR (Common Market of the South) is producing a greater integration with Brazil, resulting that in part some components are imported from Brazil.

The unrestricted demand for CFCs in the domestic refrigeration sector will lead to an estimated consumption of 1170 tons by the year 2000.

The Government of Argentina's strategy for the elimination of consumption of ODSs is clearly established in the Country Program and considers the domestic refrigeration sector a priority. The Program of reduction and elimination of consumption foresees for the domestic refrigeration sector the reduction in consumption of CFCs for foams after the year 1995 and in the refrigeration circuit after 1996, and the total elimination of consumption in the production of new equipment for the year 2000.

The approval of this project by the Multilateral Fund will undoubtedly contribute to the implementation of the designed strategy and the achievement of the goals for ODS elimination.

2.3 Description of the enterprise

AUTOSAL, S.A., is a medium-sized enterprise of national capital, which produces domestic refrigerators under license from LIEBHERR and also clothes spin dryers, has 72 employees. It currently uses CFC-11 and 12.

Through its own initiative and investments, the company has already purchased and installed the necessary high pressure foaming system for cabinets and doors, which is completely compatible for cyclopentane applications.

Current situation of the enterprise is the following:

Annual ODS consumption:	22 tons: 4,5 t of CFC-12 and 17,5 t of CFC-11 (1992)
Installed capacity:	60000 units/year
Total production:	36.000 units (1994)
Participation in sector:	4%
Market of the product:	Local and MERCOSUR countries and Chile
Origin of technology:	Part of the technology has been developed locally and the rest comes from LIEBHERR- Germany.
Enterprise ownership:	100% national capital

Through its own initiative and investment the company has already purchased and installed the necessary high pressure foaming system, one for cabinets and other for doors, which is completely adequate to use cyclopentane with small modifications

2.4 Project description

This project proposes the replacement of CFC-11 with cyclopentane for foaming, and the replacement of CFC-12 in the refrigeration circuit for hydrocarbons (isobutane). The incorporation of the cyclopentane system requires modifications in the manufacturing plant, such as storage tanks, minor installation changes and fundamentally the ventilation and safety systems in the manufacturing processes. The introduction of hydrocarbons as refrigerant implies changes in the design of the freezers with regard to the safety of the unit. In terms of the manufacturing plant, there should be modifications to the leak detection system, ventilation and safety systems in the operations including refrigerant charging, testing, and repairs. The development of these and personnel training to operate the new technologies will be done in a period of 24 months.

The equipment to be replaced will be delivered to the Argentine government for its destruction.

2.5 Justification of the technology chosen

2.5.1 Replacement of CFC-11 for cyclopentane

Currently, there are three replacement technologies of CFC-11 in insulation for domestic refrigerators: water/HCFC-141b, water/blend of HCFC-22 and 142b or HFC-134a and 152a, and cyclopentane. The first solution is an aqueous solution whose technology is similar to the one used currently, but it is a transitional solution due to the fact that HFC-141b is a transitional substance, and as such will be controlled by the Montreal Protocol, and the policy of the Government concerning this issue is to favor the projects that provide definitive solutions. The second solution uses a blend of foaming gases, requires totally new equipment, and its implementation is difficult.

The third solution, which is the one proposed in this project, is cyclopentane, a technology that has successfully been introduced in various European countries. Although the installations of cyclopentane require special considerations because of safety problems, including the flammability of this gas, it is also true that there exists considerable experience in the country concerning the handling and storage of hydrocarbons, since Argentina has a considerable production of gaseous hydrocarbons, used as fuel, including in automobiles. This substance will be available in the market at a price approximately 50% of HCFC-141b. The supplier will guarantee the correct transfer of cyclopentane technology to Autosal, S.A. (bringing an "Operational Safety Statement"). **LIEBHERR will audit the safety of installation through the provision of specialists.**

2.5.2 Replacement of CFC-12 with hydrocarbons (isobutane)

For the replacement of refrigerant, there are two possibilities: HFC-134a and hydrocarbons. HFC-134a is currently a universally accepted gas, whose technology has been widely developed and introduced commercially in many developing countries. There are numerous suppliers of gas, oil, and components for the circuit, and it appears to be the only solution in other subsectors, such as commercial refrigeration and the automobile industry. There are some doubts about its GWP and the limitation of its use in the future.

The widespread use of hydrocarbons as refrigerants has been developed by Germany. Hydrocarbons have thermodynamic properties similar to CFC-12. They can be incorporated into the refrigeration circuit without the need for any changes to the system. Since the production of hydrocarbons is not covered by patents, the local suppliers of domestic raw material inputs can provide the hydrocarbons, significantly reducing costs. Hydrocarbons require replacement of the charging equipment and the incorporation of systems for detection, ventilation, and security. Their application implies the redesign of refrigerators for their safe use. Even though the technology has not been sufficiently diffused commercially, and it has been successfully implemented in some European countries. **Autosal's technology transfer partner is LIEBHERR, who has broadly developed this technology in Germany and is diffusing this technology to article 5 countries such as China and Iran. LIEBHERR will also audit all issues related to safe operation.**

The compressor suppliers SICOM and/or EMBRACO have assured the provision of the adequate compressor and will give technical assistance for the production phase.

This project will serve to demonstrate the viability of this type of technology, and the Government of Argentina will provide the technical support through INTI, which will be responsible for providing baseline safety regulations and testing of the manufactured appliances, in accordance with the safety standards used in Germany and Italy.

2.6 Proposed conversion

2.6.1 Replacement of CFC-11 with cyclopentane

To replace the blowing agent of the polyurethane foam, Autosal, S.A. has decided to eliminate the transitional substance step and transform its installations and processes to use cyclopentane, based on the recent investment on high pressure foaming machines adequate for cyclopentane. Currently, the manufacturing processes are the following:

- Carrousel with 12 jigs (plus 2 stand-by jigs).
- Preheating and curing oven in the carrousel line, heated by air.
- preparation of the cabinet and placement inside the mold manually
- closing and opening of cabinets molds manually
- preparation of the door (gaskets, inner and outer side) manually, placement in a wooden mold, five wooden molds in the press and injection one per one.
- high pressure foaming system, with automatic injection, movement of the head manually, one for cabinets and other for doors

The replacement of CFC-11 with cyclopentane forces the changes enumerated here and that are a part of this project:

- it will be necessary bulk tank for the cyclopentane with double, piping and pumps explosion proof.
- it will be necessary to have an installation for detection of cyclopentane with enough sensors and located in the storage and working areas
- ventilation and extraction system for the storage area and the pre-mix station of the cyclopentane with polyol adapted
- ventilation and extraction system for the two foaming machines
- all the machinery and installations must be explosion-proof and grounded
- safety technicians will study the requirements for the installations before the execution of the project, and will audit the construction and the start-up
- training courses will be performed for the involved personnel

The adjudicating enterprise for the supply of the principal machinery will provide the adequate transfer of technology and **LIEBHERR will audit the global technology transfer and safety of the installation**.

The actual and recommended equipment is summarized in the following comparative table:

CFC-11	CYCLOPENTANE
STORAGE: Conditioned storage room. Containers of 1200 kgs of isocyanate and 1000 kg of polyol. Tanks of 500 liters of CFC-11 with transfer pump	Same conditioned storage room Same containers for MDI and polyol Double wall cyclopentane tank, with nitrogen between the walls, pumps and piping explosion proof, to be placed outside the plant. Sensors and monitoring system for leakage detection
POLYURETHANE INJECTION: Premixing group: Easy froth unit, 330 gr/sec with the corresponding pump for polyol/CFC 1 high pressure injection machine model A SYS 100 STD PENTA CANNON for cabinets foaming , with 1 injection head model FPL 18. 1 high pressure injection machine model A SYS 40 STD PENTA with one injection head model FPL 14 CANON, for doors	 Adjustment to the premixing group, with the corresponding sensors, extraction and emergency ventilation, monitoring and alarm system Adjustment to each injection machine with sensors, extraction and emergency ventilation, with corresponding alarm and monitoring systems
MOLDS: Pre-heating oven, heated by air Carrousel with 12 stations Containment jigs for cabinets: 14 Automatic injection, manual movement of the injection head. Production: 5000 cabinets/day (8 hours/day)	 Same pre-heating oven Same carrousel Same jigs, keeping the operating systems Sensors, ventilation and extraction, monitoring and alarm systems. Production: the same
Containment molds for doors: 7 molds, (Maximum 5 doors per mold package)	Same molds. Sensors, ventilation and extraction, monitoring and alarm systems
	Portable monitor for sensing cylopentane concentrations Grounding of the installation

2.6.2 Replacement of CFC-12 with hydrocarbons

Charging process and present installations are the following:

- prevacuum and rinsing of the circuit with CFC 12
- vacuum is performed in an stationary station until the preset value is reached
- charging of the refrigerator

The process for charging hydrocarbons is similar, but it is essential to test the circuit with an helium leak detector before charging, to assure that there are no losses in the circuit. Also, the leak detectors at the end of the line should be replaced since the ones in use are sensitive to chlorine molecules. Because this is an explosive refrigerant, a stricter framework of leak controls is required, for which the incorporation of a helium leak detector is necessary as a previous step to the charging of the units. The charging area should be provided with a ventilation system with a regime for normal working conditions and under emergencies, and the corresponding monitoring system.

A kit for servicing to replace the portable vacuum and charging machine is required. Taking into account that the technology is new, it is necessary to provide the company at least one service kit, since during the first years of implementation servicing will be done mainly by AUTOSAL.

The refrigeration circuit does not require major changes, but all the refrigerators must be redesigned to strictly comply with the required safety standards. All the refrigerator models will be tested with respect to safety standards provided by LIEBHERR and also with respect to the standard Iram 2120 Parts 1 to 4, to assure the compliance with them, which is obligatory in the Country.

As it was stated before the company produces today under license of **LIEBHERR, which will provide the technical assistance necessary for guaranteeing the transfer of hydrocarbons technology.**

The actual and recommended equipment is summarized in the following comparative table:

CFC-12	Hydrocarbons
REFRIGERANT CHARGE:	
Vacuum station, rinsing with CFC-12	Helium leak detector with helium recovery system for the preliminary leak test of components
	Vacuum station adapted for Hydrocarbons, and rinsing with R 600.
Automatic charging machine LIEBHERR, and corresponding transfer pump.	Automatic charging machine, with pressure increase pump
Prevacuum and charging machine REFCO for servicing	After service kit for R600, composed by a portable vacuum and charging machine, leak detector and lock-ring kit.
REFRIGERANT LEAK CONTROL:	
1 halogen detectors INFICON HLD 400	Hydrocarbon leak detector, with high detecting accuracy

3. PROJECT COSTS

3.1 Capital costs

The total investment necessary to cover the procurement of new equipment, installation, development costs, and training are detailed in Annex I, and is equal to US$ 1,914,912. For the imported equipment, the annex shows details for the price for FOB, embankment port, and adding an item for costs of insurance and freight. An amount equal to 10% of the total budget has been considered to cover contingency costs that may arise, given the extensive and profound changes to be introduced.

CONCEPT	US$
1. Foaming equipment	254,500
2. Refrigeration equipment	390,150
3. Technology transfer and technical assistance Foaming Refrigeration	 108,000 55,000
4. Training: Foaming Refrigeration	4,500 9,000
5. Tests and trials: Foaming Refrigeration	14,750 22,000
6. Contingencies 10%	85,790
TOTAL COSTS	943,690

3.2 Incremental operating costs:

Elimination costs of CFC-11 per unit:	U$S 1.228
Elimination costs of CFC-12 per unit:	U$S 0.0686
Total cost per unit	U$S 1.296
Total no. units per year	36,000

Total Operating Costs U$S 46,656

Incremental operational cost are only given for information, since **the enterprise does not ask for incremental cost**

3.3 Total costs of the project

Capital incremental costs: **U$S 943,690**

3.4 Cost effectiveness

A) Total capital costs:		U$S 943,960
B) Safety costs:	SC1:	U$S 568,600
	SC2:	U$S 101,850
	ICS1 + ICS2:	U$S 670,450
C) Incremental operating costs:		U$S 0
D) ODS Reduction:		22,000 kg

Cost-benefit analysis for projects = (A - B + C)/D = 12.43 US$/kg/year

4. PROJECT FINANCING

The enterprise requires financing through the Multilateral Fund of the Montreal Protocol for the project costs:

US$ 943,690

5. PROJECT EXECUTION

The World Bank, together with the National Institute for Industrial Technology will supervise the implementation of the project and will be responsible for the destruction of the equipment that be replaced through the present project.

5.1 TIMETABLE

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Description of the project	xx																							
Final draft	xx																							
Delivery of legal document		xx																						
Financial negotiations		xx	xx																					
Document signing				xx	xx																			
Disbursements						xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
Preparation of detailed work plan						xx																		
FOAMS																								
Equipment selection							xx																	
Safety project								xx																
Equipment procurement								xx	xx															
Equipment construction									xx	xx	xx	xx	xx											
Installations													xx	xx	xx	xx	xx							
Safety audit																		xx						
Initial tests																			xx	xx				
Personnel training																			xx	xx	xx	xx		
Cyclopentane production start																							xx	xx
REFRIGERANT																								
Model redesign									xx	xx	xx	xx	xx											
Personnel training																			xx					
Equipment selection										xx														
Equipment procurement											xx	xx	xx	xx										
Installation															xx	xx	xx							
Prototypes and trials																		xx	xx	xx	xx	xx		
Start of production with new technologies																							xx	xx

6. PROJECT IMPACT

This project will eliminate the use of CFCs in the first year of implementation. The incorporation of hydrocarbons as refrigerant and the cyclopentane system as insulation are radical technological innovations, and very important, that do not have precedents or previous experiences in our country. The hydrocarbons used are imported, although the goal of the project is that the supply by the local industry is achieved.

7. ANNEXES

ANNEX 1

DESCRIPTION	Quantity	Unit Cost US$	Total Cost US$	ICS1 (direct) US$	ICS2 (indirect) US$
POLYURETHANE INJECTION SYSTEM A) EQUIPMENT					
1. Double wall storage tank with nitrogen in between the walls, piping and pumps explosion proof and sensors	1	50,000	50,000	50,000	
2. Adjustment of current cabinet and provision of extraction and ventilation	1	30,000	30,000	30,000 (6)	
3. Adaptation for use of existing machinery for use with cyclopentane of the: Premixing station Injection machine. (Includes grounding)	 1 1	20,000	20,000	20,000 (2)	
4. Grounding of jigs for cabinets	1	10,000	10,000	10,000 (3)	
5. Grounding of the press for doors	1	9,000	9,000	9,000 (4)	
6. Ventilation and extraction system for installation of foaming for cabinets, connection of plans and technical assistance, two aspiration ventilators and tubing and components for the grounding and electrical commands	1	20,000	20,000	20,000 (5)	
7. Ventilation and extraction system for installation of foaming for doors: Connection of plans and technical assistance, two aspiration ventilators and tubing and components for grounding and electrical commands	1	18,000	18,000	18,000 (7)	
8. Sensors and alarm systems for installations of cabinet and door foaming, and premixing and injection unit	1	79,000	79,000	79,000 (8)	
9. Portable monitor for cyclopentane detection	1	6,500	6,500	6,500 (9)	
10. Delivery, freight and insurance (5% of equipment)			12,000	12,000	
TOTAL			**254,500**	**254,500**	
B) TECHNOLOGY TRANSFER AND ASSISTANCE FEES					
1. Assistance for installation and start-up of foaming system provided by equipment supplier, two technicians, two weeks Maintenance manual Supervision and control of installation during start-up Supervision technician for safety system, one week	1	48,000	48,000	30,000 (11)	
2. External consulting: engineering study, lay-out, classification of electric areas, modifications to plant, control, and monitors of jobs	1	60,000	60,000	60,000 (11)	

DESCRIPTION	Quantity	Unit Cost US$	Total Cost US$	ICS1 (direct) US$	ICS2 (indirect) US$
TOTAL		**108,000**	**108,000**	**90,000**	
C) TESTS AND TRIALS					
1. Trial of prototype for each model: 5 models x 15 units per model (raw materials)	75	100	7,500		
2. INTI trial, units per model	5	1,450	7,250		
TOTAL			**14,750**		
D) TRAINING					
1. Technicians, one week, supplier plant	1	3,500	3,500	3,500 (11)	
2. Training for all workers		1,000	1,000	1,000 (11)	
TOTAL			**4,500**	**4,500**	
REFRIGERATION SYSTEM A) EQUIPMENT					
1. Automatic equipment for recovery and charge of hydrocarbons Accessories: interphase for printer, remote control panel, complete system of gas sensors	1	160,000	167,950		80,000 (12)
2. Dosifying pump for HCs	1	6,500			
3. Charging accessories: hose connectors, reducers	1	1,450			
4. Leak detector for hydrocarbons, for the charging line	1	35,000	35,000		15,000 (10)
5. Kit for servicing, composed by: Detector Sensors Filter for testing Maintenance kit Filter connections	1	6,700	6,700		2,000
6. Helium leak detector	1	32,000	32,000	32,000 (13)	
7. Cabin for gas extraction, sensors, safety system for charging area	1	130,000	130,000	130,000 (14)	
8. Delivery, freight, insurance (5%)			18,500	8,100	4,850
TOTAL			**390,150**	**170,100**	**101,850**
B) TECHNOLOGY TRANSFER AND ASSISTANCE FEES					
1. Technical assistance from international expert for conversion to HCs, safety measures, etc.		50,000	50,000	25,000 (11)	
2. Technician from supplier for assistance and training for charging system, one week		5,000	5,000	2,500 (11)	
TOTAL			**55,000**	**27,500**	
C) TESTS AND TRIALS					
1. Trials and evaluation of refrigeration system, 2 units per model, 5 models	10	500	5,000		
2. Tests in INTI laboratories, to assure compliance with safety standards, 2 units per	10	1,700	17,000	17,000 (13)	

DESCRIPTION	Quantity	Unit Cost US$	Total Cost US$	ICS1 (direct) US$	ICS2 (indirect) US$
model, 5 models					
TOTAL			**22,000**	**17,000**	
D) TRAINING					
1. Training of personnel during implementation and start-up Training for work with flammable liquids in charging zone	1	9,000	9,000	5,000(11)	
TOTAL			**9,000**	**5,000**	
TOTAL			**857,900**	**568,600**	**101,850**

NOTES:

(1) Special tank for storage of cyclopentane,

(2) Corresponds to the modification of the current injector and premixing station to operate with cyclopentane, the components involve mixing devices, valves, and explosion proof presostats, cables, according to standards IP55

(3), (4) Correspond to the grounding of the current molds to work with cyclopentane

(5) , (6), (7), (8), (9), and (14) Safety systems exclusively necessary for the use of cyclopentane or isobutane.

(10) Special detector for isobutanes, more accurate than the common ones used with HFC-134a, to detect lowest leakage of isobutane in the charging line.

(11) Required due to the technical assistance, supervision, and control of the installation and audit of the safety systems necessary for cyclopentane or isobutane use.

(12) Difference between the conventional machine for HFC-134a and the necessary for HCs. Related costs because it is necessary that engines, connections, and electrical material be explosion-proof.

(13) To test all evaporators before foaming, to assure there will be no leakage within the foam

ANNEX II

1. Elimination of CFC-11

Actual Foam Composition:
Weight x Unit: 5 Kg.

Isocyanate	100p.p.	37%	1.85 kg.	US$ 2.11	US$ 3.9
Polyol	130p.p.	48%	2.40 kg.	US$ 2.11	US$ 5.1
CFC-11	40p.p.	15%	0.75 kg.	US$ 2.50	US$ 1.875
			Total		US$ 10.875

Composition replacing CFC-11 with cyclopentane
Foam weight per unit: 5 Kg.

Isocyanate	144p.p.	56,25 %	2,81 Kg.	2,11 U$S	5.929 U$S
Polyol	100p.p.	39,00 %	1,95 Kg.	2,90 U$S	5.655 U$S
Cyclopentane	12p.p.	4,68 %	0,24 Kg.	2,21 U$S	0.519 U$S
					2.103 U$S

Total elimination of CFC-11: 12.103 - 10.875 = U$S 1.228

2. Elimination of CFC-12:

Redesign of the refrigeration circuit: Incremental operating costs are expected due to evaporator redesign, but it cannot be evaluated up to the final prototypes are ready.

Replacement of compressor for CFCs by HCs:
No incremental costs are expected.

Replacement of CFC-12 with HCs:

Average consumption per refrigerator:		140 g (CFC-12)
		40 to 45% of CFC-12 charge for isobutane
CFC-12	0.140 kg x 4.91 US$/kg =	US$ 0.6874
HCs	0.063 kg x 12 US$/kg =	US$ 0.756
Difference:		US$ 0.0686

Elimination of CFC-11	US$ 1.228
Elimination of CFC-12	0.0686
Total per unit	US$ 1.296

Total per year (base 1994): 1.296 x 36,000 units = US$ 46,656

Country of origin: ARGENTINA

Project title: Elimination of CFCs in domestic refrigerator production plant in AUTOSAL, S.A

Sector/sub-sector Domestic refrigeration

Relationship to country program (World Bank)

Note *This review addresses only the refrigerant conversion part of the project, it does not address the part related to the foam blowing agent conversion.*

Technology

- In this project isobutane is selected as the substitute refrigerant for CFC-12. Isobutane is one of the recommended alternatives for CFC-12 in domestic refrigeration.
- AUTOSAL currently produces appliances under license from LIEBHERR, Germany. LIEBHERR will also deliver the necessary technology and address all safety issues related to the application of isobutane. Due to this cooperation, a successful project implementation can be expected.
- Not all arguments used for selecting isobutane are appropriate (e.g. use of raw materials, low price of the refrigerant, no changes to the system necessary). Nevertheless the choice for isobutane is acceptable.
- AUTOSAL will obtain its isobutane compressors from SICOM and Embraco, Brazil.
- The other technology considered was HFC-134a. This was not selected mainly because of concerns with regards to the GWP value.

Environmental impact

Isobutane has no ODP and a negligible GWP. Safety and health impacts during production are addressed properly with the proposed production line modifications. Appliances will be redesigned in order to be safe in use.

Project costs

Incremental investments:

- In general the equipment requested is essential for the conversion process and costs are reasonable (this includes the helium leak detector which is considered essential for the application of flammable refrigerants). Also the production line modifications proposed are acceptable.
- The costs of training, testing and trials are reasonable.
- The technology transfer fee requested is reasonable.

Incremental operational costs:

- No incremental operational costs are being claimed.

When the UAC value is calculated for the refrigerant conversion process only, a number of 20.1 USD/kg/y is obtained which is reasonable compared to other projects of this size.

Implementation timeframe Reasonable

Relevance and adequacy of information provided Sufficient, taking into account additional information obtained from the responsible World Bank consultant

Recommendations Approval as proposed

Janssen M.J.P.,OORG MM338, Eindhoven, The Netherlands, 5-June-1995

ARGENTINA - AUTOSAL

TECHNOLOGY

The enterprise manufactures domestic refrigerators and proposes to change its rigid polyurethane urethane insulating foam technology from the blowing agent CFC 11 to cyclopentane. Cyclopentane technology is now well proven in this sector since its introduction in Germany in 1993. Since then more than 10 million units have been produced with this technology and its use has spread to Australia, New Zealand and to some developing countries.

The enterprise considered other technologies including both HCFC and HFCs but chose cyclopentane on the grounds that it is a zero ODP technology in line with the Argentinean national plan.

The enterprise has already installed high pressure dispensing equipment on both the cabinet and door lines. The project involves relatively minor modifications of these machines together with a range of safety equipment and modifications.

ENVIRONMENTAL ISSUES

The main issue relates to the safe operation of the plant with highly flammable cyclopentane. The enterprise has proposed Liebherr (of Germany) as its overall safety advisor who will provide safety guarantees. Liebherr is the world's most experienced user of cyclopentane technology in this subsector. The equipment supplier will also provide guarantees including technology transfer.

Cyclopentane has a zero ODP and a very low GPW and is hence a long term solution.

The enterprise should ensure that it satisfies local VOC emission controls.

PROJECT COSTS

The overall grant cost effectiveness meets EC guidelines. The capital items are all justified.

Funds are not requested for incremental operating costs.

IMPLEMENTATION TIMEFRAME

This is acceptable.

RECOMMENDATION

Approval

GMFJ/kd/6/6/95

THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

PROJECT COVER SHEET

COUNTRY:	**ARGENTINA**
PROJECT NAME:	**Elimination of CFCs in the manufacturing plant of domestic refrigerators of BRIKET S.A.**
SECTOR COVERED:	**Domestic refrigeration**
ODS CONSUMPTION IN AFFECTED SECTORS:	**762 tons (1992)**
PROJECT IMPACT:	**Phase out of annual consumption of 24 tons of CFC-11 and 6 tons of CFC-12**
PROJECT DURATION:	**2 years**
PROJECT ECONOMIC LIFE:	**10 years**
TOTAL PROJECT COST:	**Capital cost: US$ 747.400**
INTERMEDIARY FEE:	**US$ 22.400 (based on 3% incremental capital cost)**
PROPOSED GRANT:	**US$ 769.820**
COST EFFECTIVENESS:	**13,19 kg SAO/year (without safety related costs)**
IMPLEMENTING AGENCY	**World Bank**
COORDINATING NAT. AGENCIES	**Ozone Program Office/ National Institute of Industrial Technology**
BENEFICIARY ENTERPRISE	**BRIKET S.A.**

PROJECT SUMMARY

This project will eliminate the use of CFCs in the manufacturing of domestic refrigerators at BRIKET S.A. plant, located in Rosario, Santa Fé in the Republic of Argentina. The CFC-11 used as foaming agent in the production of insulating foams will be replaced with cyclopentane, and the CFC-12 used in refrigeration circuit will be replaced with HFC-134a. 24 tons of CFC-11 and 6 tons of CFC-12 will be eliminated per year (28 tons of ODS). The fund required will be used to retrofit the production lines, the start-up and tests of the new models, the training of personnel and the incremental operating costs resulting from the changeover for a period of 1 year.

COUNTRY BACKGROUND

The Country Program of the Republic of Argentina for the protection of the ozone layer was presented and approved during the XIV meeting of the Executive Committee of the Multilateral Fund of the Montreal Protocol. This Country Program reflects the objectives of the Government and Industry to reduce the consumption of substances that deplete the ozone layer. The Program foresees the total elimination of ODS for the year 2006, before the date established by the Montreal Protocol and its amendments. The reasons for this policy are the environmental impact of this decision and the restrictions that the global agreement will impose on the industry product that contains ODS and its production. Argentina has consumed in 1992, the base year for the Country Program, 1338 tons of CFC-11 and 2408 tons of CFC-12. Due to the growth in the sectors, we estimate that consumption has increased 7% during 1993, and has increased an additional 6% during 1994. Both substances are produced domestically (660 tons of CFC-11 and 772 of CFC-12, and are also imported (1048 tons of CFC-11 and 1990 tons of CFC-12).

PROJECT OBJECTIVE

The objective of the project is the complete elimination of the use of chlorofluorocarbonated compounds in the manufacture of domestic refrigerators in the plants of the company BRIKET S.A. located in Rosario, Provincia de Santa Fé, Argentina. The CFC-11 used as foaming agent in the production of polyurethane foams used in thermal insulation will be replaced by cyclopentane, and the CFC-12 used as a refrigerant will be replaced by HFC-134a in the refrigerating system in the domestic refrigerators. The project does not intend to increase installed capacity.

SECTOR BACKGROUND

In 1992, 1441 tons of CFC-12 and 33 tons of HCFC-22 were consumed in the refrigeration sector in Argentina, in the refrigeration circuit. This sector is the largest consumer of ODS. In the refrigeration sector, 440 tons of CFC-12 were consumed in the domestic sector, of which 190 tons are used in new equipment and 250 tons are used for servicing operations. In the commercial refrigeration sector, the consumption equals 668 tons of CFC-12 (68 tons for new equipment and 600 tons for servicing operations) and 333 tons of HCFC-22. Refrigerated transport and the fleets consume 333 tons of CFC-12.

In 1992, the foams sector consumed a total of 1274 tons of CFC-11 and 209 tons of CFC-12 (second largest consumer), of which 322 tons of CFC-11 were consumed in the production of insulating foams for domestic refrigerators, and 21 tons for commercial refrigerators. The production of domestic refrigerators in 1992, based on the Country Program, was equal to 761.000 units. This number grew by 7% in 1993, and there was an estimated growth rate of 6% for 1994.

The domestic sector produces refrigerators and freezers. It is basically composed of more than 22 enterprises, of which 7 control approximately 72% of the market. Of these 7 enterprises, 2 are of foreign capital and the other 5 are 100% national capital. The principal industries have expressed the will to immediately replace the CFCs. Some of them already use the CFC-reduced foaming process.

Some of the CFCs are produced locally and some are imported. With respect to the compressor, the local industry provides 30% of the market, and the remaining 70% is imported mostly from Brazil. The establishment of MERCOSUR (common market of the southern cone) is leading to increases integration with Brazil, resulting in the import of some components from Brazil. An unrestricted demand of CFCs in the domestic refrigeration sector would result in estimated consumption of 1770 tons by the year 2000. The strategy of the Argentinean Government for the phase out of ODS consumption is clearly set forth in the County Program, which considers the domestic refrigerators sector to be a priority. The program for reduction and elimination of consumption in the domestic refrigeration sector establishes the schedule for the reduction in consumption of CFCs to begin after 1995 for foam applications after 1996 for refrigeration circuit applications, and reaching total elimination of consumption in the production of new equipment in the year 2000. The approval of this project by the Multilateral Fund undoubtedly will contribute to the implementation of the planned strategy and the achievement of the objectives of ODS.

ENTERPRISE BACKGROUND

BRIKET S.A. is a local medium size company, in expansion. Background figures for the year base 1993 are the following:

Annual ODS consumption: 30 tons: 6 tons of CFC-12 and 24 tons of CFC-12

Installed capacity: 45.000 units per year

Total production: 33.000 units per year

Product Market: Local, with some exports to Uruguay, Paraguay and Brazil

Source of the present technology: Developed by the company

Enterprise ownership: 100% national capitals

The company is beginning to work with reduced CFC-11.

PROJECT DESCRIPTION

This project is designated to replace CFC-11 with cyclopentane for foams, CFC-12 with HFC-134a as refrigerant for the refrigeration circuit, and eliminate the methylene chloride used as a cleaning agent. Project implementation and the personnel training needed to operate the new technologies will take 24 months.

FOAMING SYSTEM CONVERSION

To replace the CFC-11 used as blowing agent of the polyurethane foams, Briket S.A. has decided to eliminate the step with a transition substance and convert its installations and processes to use cyclopentane. Presently Briket S.A. performs the following processes:

* manual cabinets and doors preparation, manual placement in mold.
* automatic opening and closing of molds.
* polyurethane foam injection, manual injection head movement,
* cleaning of injection heads with methylene chloride, consumption: 25 liters per day

The replacement of CFC-11 by cyclopentane requires the changes listed below and that are part of this project:
- a tank for the bulk reception of cyclopentane, piping and pumps that complies with the safety requirements corresponding combustible liquids.
- as the tank will be placed inside, cyclopentane detection installation with sufficient sensors and located in storage areas as well as work areas.
- fire extinguishing installation with sufficient sensors and located in storage areas as well as work areas,
- pre-mix equipment for cyclopentane with polyol adapted for the use of flammable and explosive substances,
- change of the low pressure injection machines for high pressure injection machines, able to handle cyclopentane, which eliminates the use of methylene chloride. Briket proposes to replace three injections machines for only one for cabinets and doors,

- Present mold system and gas heated oven has to be replaced. Briket proposes an injection system prepared for 4 masks (two of them to be provided by Briket) with one injection head with a nitrogen sweeping valve for cabinets foaming, contained inside a chamber with its own functioning and emergency ventilation chamber and the individual
- injection machine for doors is not requested, but it is proposed to replace the individual molds system inadequate for cyclopentane by a drum with 3 positions, with independent ventilation and extraction system
- all machinery and installations will be explosion proof and grounded,
- safety technicians will study the requirements for the installations before execution of the project and will audit the construction and the start-up of the plant.
- the beneficiary will negotiate a comprehensive technology partnering agreement in order to ensure appropriate technology transfer and assign responsibility for the overall safety of the installation.

Due to the cost effectiveness limits established during the XVI Meeting of the Ex. Com. the company has modified its original project and **the required installation includes only the basic elements to allow the conversion. In order to convert the facility to a comparable production facility with the new technology, the company will assume charges for some components such as two molds for cabinets, some automatic devices, some tests and the raw material needed for trials.**

The following table shows the present and the required equipment:

CFC-11	CYCLOPENTANE
1 Injection machine, low pressure. OMS Model 2002/C60 1:1 origin Italy for cabinets foaming cabinets with the corresponding water chiller. Capacity: 00 60 kg/min 1 Injections machine, low pressure. VIKING, for cabinets foaming Capacity: 15 kg/min 1 Injection machine, low pressure. VIKING for doors foaming,. Capacity 15 kg/min	1 Injection machine, PERROS, Model HFPE, high pressure for cabinets and door foaming, with the corresponding feeding and premixing group. Capacity: 9,3 - 20 kg/min. for doors 46,8 - 93 kg/min. for cabinets
Cabinets molds: 4, hydraulic moved and one pneumatic moved heated by water. Production: 150 - 200 cabinets per day	Preheating oven. 4 molds heated by water, with the corresponding ventilation and extraction group, sensors and safeties. (Two molds are going to be provided by BRIKET in order to achieve cost effectiveness factor) Production: 150 cabinets per day
Semiautomatic device for doors injection, with 6 molds, chain translated, heated by air (gas burner)	Drum system, with 3 molds, for door injection, with the corresponding ventilation and extraction group, sensors and safeties.

The Argentine Government will be responsible for the destruction of the replaced equipment.

REFRIGERATION SYSTEM CONVERSION

The current charging process of CFC-12 consists of the injection in liquid state of the pressured liquid (12 bar) after the machine sense the correct previous vacuum, according to the following sequence:

* through a transport band, the refrigerator comes in the pre vacuum area, velocity 37 cm/min
* 8 vacuum pumps produce vacuum in the high and low pressure part of the refrigeration system, during approximately 30 minutes

* immediately CFC-12 is charged through the corresponding machine

The charging process of HFC-134 a is similar, but the materials of the charging machine have to be resistant to HFC-134 a. At the time of disconnecting the charging machine, there has to be a way of eliminating the habitual gas purge of the residues in the hose. The injection unit for the project has to comply with this requirement. It is also common that defects will appear during the assembly process that will require the evacuation of the charged gas. A recovery system for HFC-134a will be installed for this function. Also, the leak detectors should be replaced because the current ones are sensitive to chlorine molecules. The vacuum pumps can be used after undergoing an adequate cleaning process. The refrigeration circuit should be optimized to use HFC-134a, through the test of new compressors, dehydrating filters, and new capillaries due to the lower flow of refrigerant at low temperature. The use of ester-type oil in the compressors require greater care in terms of humidity and cleanliness. All the refrigerator models should be tested for compliance with IRAM 2120 Parts 1 to 4, national standards that are in effect in Argentina. Raw materials for testing will be covered by Briket

BRIKET does not have a formal technology transfer partner. The present CFC-12 has been developed by the company itself. The company is now performing some tests with HFC-134a on several units and in other projects approved by the Fund, the compressor supplier is going to provide technical support for the conversion. The assistance of an international expert is also provided.

The following table shows the present and required equipment:

CFC-12	HFC-134a
VACUUM 8 pumps, "VARIAN" model SD 200 with capacity of 10 m3/hour	Repair of the present vacuum pumps
REFRIGERANT CHARGE: Automatic charging machine with digital panel, CEMA Mod F1 and accessories for CFC-12 charging	Charging Machine for HFC-134a CEM 5, including supply pump CEMF 66 and accessories.
RECOVERY AND RECYCLING MACHINE: Machine for recovery of refrigerant and charge control, ROBINAIR, mod 17501 B for CFC-12, CFC-22, CFC-500 y CFC-502	Recovery machine of HFC-134a with accessories..
REFRIGERANT LEAKAGE DETECTION 2 Chlorine detectors, YOKOGAWA MOD H 25 C - Sensitivity 3,5 - 7 gr refrigerant	1 Halogen leak detector, YOKOGAWA,

The Argentine Government will be responsible for the destruction of the replaced equipment.

JUSTIFICATION OF THE TECHNOLOGY SELECTED

Replacement of CFC-11

For the foaming technology, there are presently three replacements for insulation in domestic refrigerators, water/HCFC-141b, water/HCFC-22 and 141 b blend or HFC-134a and 152a blend, and cylopentane. The first solution is an aqueous solution whose technology is similar to the one used now, but it is a transition substance because HCFC-141b is as transition substance, and as such is controlled by the Montreal Protocol, and the government policy is to support projects with definite solutions when feasible. The second solution uses blends of foaming gases, requires totally new equipment, and its start up is difficult and troublesome. The third solution, the one proposed in this project, is cyclopentane technology, which has been successfully introduced in European countries, most notably in Germany. The installation of cylopentane requires special considerations for safety problems due to its flammability, but there is considerable experience in Argentina in the handling and storage of hydrocarbons, since Argentina has a considerable production of hydrocarbons, used as fuel for automobiles. This substance is available in the market at a cost approximately 50% that of HCFC-141b. In addition, there is experience in the country in operating high pressure machines for foaming.

The supplier of the high pressure equipment will guarantee the proper technology transfer of cyclopentane to Briket S.A. (offering an Operational Safety Statement), as well as the global guarantee on the safety of installation by sending safety experts who will audit the installation.

Replacement of CFC-12

There are two options for replacement of CFC-12 as a refrigerant: HFC-134a and hydrocarbons. HFC-134a has been selected for replacement of the CFC-12 refrigerant in domestic refrigerators because it is presently accepted worldwide, and its technology has been developed thoroughly and has been introduced commercially in many developed countries. There are numerous suppliers of gas, oils and components of the circuit, and it appears to be a unique solution in other subsectors such as commercial refrigeration and the automotive industry. There are certain doubts concerning its GWP, but there are no nearby dates for its limitation. The option of using hydrocarbons as refrigerants has been developed in Germany and units are being manufactures with isobutane. It may appear to be a promising technology, but Briket S.A. thinks that there is not enough industrial experience to adopt this technology.

PROJECT TOTAL COSTS

CAPITAL INCREMENTAL COSTS

The total investment necessary to cover the procurement of the new equipment, installations, development and training costs, detailed in Annex 1 is U$S 711.810. For the imported equipment, the prices detailed in annex I is the F.O.B. value according to the supplier's quotation. C.I.F. cost, including insurance, amounting to 5% of F.O.B. was added. Only 5% for contingencies of the above value was added. A project costs summary is included below:

EQUIPMENT	U$S
1. Foaming system	571.410
2. Refrigeration system	56.910
3. Technology transfer and technical assistance: Foaming Refrigeration	40.000 18.500
5. Training: Foaming Refrigeration	4.500 6.000
6. Text and trials: Foaming Refrigeration	7.250 7.250
7. Contingencies (5% of equipment)	35.590
TOTAL COSTS	747.400

INCREMENTAL OPERATIONAL COSTS

The company do not ask incremental cost, anyway a summary is given below:

Phase out cost of CFC-11 per unit	U$S 1,417
Phase out cost of CFC-12 per unit	U$S 5,052
Total operational incremental cost per unit	U$S 6,469
Number of units produced per year	33.000
Total operational incremental costs	**U$S 213.477**

PROJECT TOTAL COSTS

a. Capital Incremental Costs	U$S 747.400
b. Operational Incremental Costs	U$S 0

PROJECT TOTAL COST	**USS 747.400**

Cost effectiveness:

A) Capital Cost :	U$S 747.400
B) Safety related issues: ICS1:	U$S 250.170
ICS2:	U$S 101.430
ICS1 + ICS2 =	U$S 351.600
C) Operational incremental costs:	U$S 0
D) ODS reduction :	30.000 kg/per year

Cost effectiveness = (A+C-B)/D = 13,19 USS/kg/year

PROJECT FINANCING

Briket S.A. requests the donation of 100% of the project costs, reflecting the 100% local ownership calculated:

USS 747.400

PROJECT EXECUTION

The World Bank jointly with the National Institute of Industrial Technology will supervise the project implementation.

TIMETABLE

The project execution demands two years, see below a preliminary schedule:

TIMETABLE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Project description	x																							
Final project	xx																							
Mailing of the legal documents		xxx																						
Financial agreements		xx	xxx																					
Document signing				xxx	xxx																			
Disbursements						xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx
Execution of detailed workplan						xxx																		
FOAMS																								
Equipment Selection							xxx																	
Safety project								xxx																
Equipment procurement								xxx	xxx															
Equipment construction								xxx	xxx	xxx	xxx	xxx	xxx											
Cyclopentane system procurement									xxx	xxx														
Building of Cyclopentane installations											xxx	xxx	xxx	xxx										
Safety audit															xxx									
Initial trials																xxx	xxx							
Training of Personnel																xxx	xxx							
Start up																							xxx	xxx
REFRIGERANT																								
Models redesign							xxx	xxx	xxx															
Personnel training										xxx														
Equipment selection									xxx															
Equipment procurement										xxx	xxx													
Installation												xxx	xxx	xxx										
Prototyping and tests															xxx	xxx	xxx	xxx	xxx	xxx				
Start up																					xxx	xxx	xxx	xxx

PROJECT IMPACT

This project will eliminate the use of, at least 6 tons of CFC-12, 24 tons of CFC-11 and 58 tons of methylene chloride in the first year of implementation.

LEGAL REPRESENTATIVE OF BRIKET S.A.

The following person will represent the company for document signing:

Vice-president: Mr. Roberto Luis Juan LENZI

ANNEX

ANNEX I

Description	Quantity	Unit Cost U$S	Total Cost (F.O.B.) U$S	ISC1 (direct) U$S	ISC2 (ndirect) U$S
FOAM SYSTEM A) EQUIPMENT					
1. Storage area, Conditioning, cyclopentane tank, gas detectors, ventilation and extraction system	1	30.000	30.000	30.000 (1)	
2. Injection System PERROS for cabinets foaming cabinets including: * Preheating oven * Two masks (Briket will buy another two) * Transport car for the injection head * Electrical wiring and panel molds	1				(2)
3. Injection unit PERROS for cabinets and doors, two speed, injection head for cabinets,	1				(3)
4. Premising unit - Economix	1				(4)
5. Injections Systems for door foaming with 3 masks heated by water, including: * Hydraulic unit and connections * Electric hiring and panel * Injection car (without motorization)	1				(5)
6. Injection Head for doors, electrical wiring and installation	1				(6)
7. Ventilation and extraction system for cyclopentane, including: * gas detectors for molds * nitrogen sweeping system for molds * ventilation and extraction system for injection heads * gas detectors an monitoring system for injection zone * nitrogen sweeping system for injection machines * boxes for door and cabinets foaming * premising unit	1			(7)	
	Subtotal	484.200	484.200	120.000	92.000
8. Fire protection system	1	30.000	30.000	30.000 (8)	
9. Shipping and insurance (CIF costs) (5% of the F.O.B. value)			27.210	9.000	4.600
TOTAL			**571.410**	**189.000**	**96.600**
B) TECHNOLOGY TRANSFER AND TECHNICAL ASSISTANCE					
1. Technician for supervision of safety system, one week	1	15.000	15.000	15.000 (9)	

Description	Quantity	Unit Cost U$S	Total Cost (F.O.B.) U$S	ISC1 (direct) U$S	ISC2 (ndirect) U$S
External consultant: engineering, lay out, electrical areas codification, plant modifications, control and monitoring of re conversion	1	25.000	25.000	25.000 (10)	
TOTAL			**40.000**	**40.000**	
C) TEST AND TRIALS					
1. Foaming test in cabinets: 5 models x 15 units per model (raw materials) and sample shipping	75	145	to be covered by Briket		
2. Type Testing according to national standards in a national laboratories (INTI), 1 units per model	5	1450	7.250		
3. Follow up of field test, 50 units	50	60	to be covered by Briket		
TOTAL			**7.250**		
D) TRAINING					
1. Technicians, 1 week, supplier plant	1	3.500	3.500	3.500 (11)	
2. Fire fighting course	1	1.000	1.000	1.000(12)	
TOTAL			**4.500**	**4.500**	
REFRIGERATION SYSTEM					
A) EQUIPMENT					
1. Charging machine HFC-134a, EMAC 25, Robinair	1	29.700	29.700		
2. HFC-134a dosing pump for charging machine Robinair	1	6.800	6.800		
3. Retooling of the vacuum pumps	8	1.000	8.000		
4. Leak detector system for HFC-134 a: Detector Sensor Filter for tests Maintenance Kit Filters Kit	1	5.940	5.940		
6. Recovery system for HFC-134a.	1	3.760	3.760		
7. Shipping and insurance costs (CIF costs, 5% of F.O.B. costs)			2.710		
TOTAL			**56.910**		
B) TECHNOLOGY TRANSFER AND TECHNICAL ASSISTANCE					
1. International expert review of concept		15.000	15.000		
2. Technical assistance for charging system provided by supplier, one technician, one week		3.500	3.500		
TOTAL			**18.500**		

Description	Quantity	Unit Cost U$S	Total Cost (F.O.B.) U$S	ISC1 (direct) U$S	ISC2 (ndirect) U$S
C) TEST AND TRIALS					
1. Destructive evaluation and test of the refrigeration circuits. 2 units per model. 5 models	10	300	to be covered by Briket		
2. Type testing according to national standards in national laboratories (INTI). 1 units per model. 6 models	5	1450	7.250		
3. Follow up of field test. 50 units	50	300	to be covered by Briket		
TOTAL			**7,250**		
D) TRAINING					
1. Training of personnel during implementation and start-up			**6,000**		
Contingencies (5% of the capital costs)			35.590	16.670	4.830
TOTAL			**747.400**	**250.170**	**101.430**

NOTES:

(1) Conditioning of the storage area. to comply with the safety issues related to cyclopentane.

(2). (5) and (6) Estimated costs debt to the safety needed to use Cyclopentane. instead of HCFC-141b, including valves. switches. box. fans. motors. electrical wiring and board according to IP55 standards and grounding. etc.

(3) Cost related with the nitrogen pressurization system, installation and electric wiring according to IP55 standards. ventilation system. ducts and fans. box for ventilation systems and gas detectors, based on first supplier quotation and grounding

(4) Corresponding to the difference between the cost of an injection machine adequate to use cyclopentane and the cost of the same machine for HCFC-141b.

(7) and (8) Safety system needed only if cyclopentane is used.

(9). (10). (11) and (12) Technical assistance, control and supervision of the safety related issues for the foaming installation.

ANNEX II

1. CFC-11 phase out:

Foam composition year 1997 (reduced CFC)
Foam weight per unit : 5 Kg.

Isocyanate	140 p.p.	54,2 %	2,71 Kg.	2,11 U$S	5,718 U$S
Polyol	100 p.p.	38,8 %	1,94 Kg.	2,11 U$S	4,093 U$S
CFC-11	18 p.p.	7,0 %	0,35 Kg.	2,5 U$S	0,875 U$S
					10,686 U$S

Foam composition using cyclopentane
Foam weight per unit: 5 Kg.

Isocyanate	144 p.p.	56,25 %	2,81 Kg.	2,11 U$S	5,929 U$S
Polyol	100 p.p.	39,00 %	1,95 Kg.	2,90 U$S	5,655 U$S
Cyclopentane	12 p.p.	4,68 %	0,24 Kg.	2,21 U$S	0,519 U$S
					12,103 U$S

Total Cost of CFC-11 phase out : 12,103 - 10,686 = 1,417 USS

2. CFC-12 phase out:
Compressor replacement for R134a
CFC-12 compressor price : 44,13 U$S
HFC134a compressor price: 47,22 U$S
Difference : 47,22 - 44,13 = 3,09 U$S
CFC-12 replacement by R134a:
Present refrigerant charge: 180 grs.
CFC-12 0,180 Kg. x 3,50 U$S/Kg.= 0,63 U$S
HFC134a 0,162 Kg. x 16 U$S/Kg.= 2,592 U$S
Difference : 2,592 - 0,63 = 1,962 U$S

CFC-12 total phase out operational cost : 5,052 USS

CFC-11	1,417
CFC-12	5,052 U$S

Total per Unit: 6,469 USS

Total per year (base 1993): 6,469 USS per unit x 33,000 units = 213,477 USS

Country of origin: ARGENTINA

Project title: Elimination of CFC in the manufacturing plant of domestic refrigerators of BRIKET S.A.

Sector/sub-sector Domestic refrigeration

Relationship to country program (World Bank)

Note *This review addresses only the refrigerant conversion part of the project, it does not address the part related to the foam blowing agent conversion.*

Technology

- In this project HFC-134a is selected as the substitute refrigerant for CFC-12. In domestic refrigeration HFC-134a technology is a proven and acceptable (nontransitional) technology to reduce CFC-12 consumption.
- The company BRIKET S.A. does not have a formal technology transfer partner. The company intends to develop the HFC-134a technology in house with assistance from compressor and equipment suppliers, as well as external support (for which provisions are present). Due to these facts, a successful project implementation can be expected.
- Other technologies than HFC-134a were considered (hydrocarbons) but were not selected because of the development state which was considered to low by the company. From the zero ODP technologies HFC-134a is one of the most cost effective solutions.

Environmental impact

HFC-134a has an ODP of zero and a GWP of 1300. For domestic refrigeration a GWP of this magnitude is negligible.

Project costs

Incremental investments:

- The equipment requested is essential for the conversion process and costs are reasonable.
- Costs of training and technical assistance are reasonable.
- A large part of the costs for tests and trials are incurred by the company.

Incremental operational costs:

- Operational costs are calculated correctly but no funding for these costs is being claimed.

The UAC value, calculated for the refrigerant part separately, amounts to 2.7 USD/kg/y which is very low compared to other, similar, projects (mainly because no operational costs are claimed)

Implementation timeframe Reasonable

Relevance and adequacy of information provided Reasonable

Recommendations Approval as proposed

Janssen M.J.P.,OORG MM338, Eindhoven, The Netherlands, 22-May-1995

ARGENTINA - BRIKET

TECHNOLOGY

The refrigerator manufacturer Briket is proposing to replace CFC 11 in the insulating foam by cyclopentane. Cyclopentane technology is in widescale use in Europe and elsewhere and is a well proven technology. Since its introduction in 1993 well over ten million units have been manufactured using this technology.

Other technologies were considered, including those based on HCFCs and HFCs. HCFC technologies are rejected because they are not zero ODP and hence not in line with Argentine government policy. The gaseous HFCs require new equipment and are difficult to use. Furthermore, they are not used by the industry in any country.

ENVIRONMENTAL ISSUES

Cyclopentane has a zero ODP and, in terms of ozone depletion, represents a long term solution.

The enterprise should realise that cyclopentane is a VOC and ensure that it will satisfy any regulations controlling the emissions of such substances.

The safety issue due to the flammable nature of cyclopentane is adequately addressed.

The enterprise has ascertained that the proposed equipment supplier will provide a guarantee that the installation will provide the required level of safety in operating with highly flammable cyclopentane and safety experts will supervise and audit the equipment and its operation.

PROJECT COSTS

The grant cost effectiveness is within the EC recommendations. The capital items proposed are all justified and are appropriate for the chosen technology. The enterprise has achieved economics by replacing three low pressure dispensing machines by one high pressure dispenser.

Operational costs are clearly displayed but incremental costs are not being claimed by the enterprise.

IMPLEMENTATION TIMEFRAME

This is acceptable.

RECOMMENDATION

Approval

GMFJ/kd/6/6/95

THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

PROJECT COVER SHEET

COUNTRY:	ARGENTINA
PROJECT NAME:	Elimination of CFC in the manufacturing plant of domestic refrigerators of NEBA S.A.
SECTOR COVERED:	Domestic refrigeration
ODS CONSUMPTION IN AFFECTED SECTORS:	762 tons (1992)
PROJECT IMPACT:	Phase out of annual consumption of 29 tons: 24 tons of CFC-11 and 5 ton of CFC-12
PROJECT DURATION:	2 years
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	Capital cost: U$S 721.070
INTERMEDIARY FEE:	U$S 21,632 (based 3% incremental capital cost)
PROPOSED GRANT:	U$S 742,702
COST EFFECTIVENESS	13,48 kg SAO/year (without safety costs)
IMPLEMENTING AGENCY	World Bank
COORDINATING NAT. AGENCIES	Ozone Program Office/ National Institute of Industrial Technology
BENEFICIARY ENTERPRISE	NEBA S.A.

PROJECT SUMMARY

This project will eliminate the use of CFCs in the manufacturing of domestic refrigerators at NEBA S.A. plant, located in San Fernando del Valle de Catamarca, in the Republic of Argentina. The CFC-11 used as foaming agent in the production of insulating foams will be replaced with cyclopentane, and the CFC-12 used in refrigeration circuit will be replaced with HFC- 134a. 24 tons of CFC-11 and 5 tons of CFC-12 will be eliminated per year (29 tons of ODS). The fund required will be used to retrofit the production lines , the start-up and tests of the new models, the training of personnel and the incremental operating costs resulting from the changeover for a period of 1 year.

COUNTRY BACKGROUND

The Country Program of the Republic of Argentina for the protection of the ozone layer was presented and approved during the XII meeting of the Executive Committee of the Multilateral Fund of the Montreal Protocol. This Country Program reflects the objectives of the Government and Industry to reduce the consumption of substances that deplete the ozone layer. The Program foresees the total elimination of ODS for the year 2006, before the date established by the Montreal Protocol and its amendments. The reasons for this policy are the environmental impact of this decision and the restrictions that the global agreement will impose on the industry product that contains ODS and its production. Argentina has consumed in 1992, the base year for the Country Program, 1338 tons of CFC-11 and 2408 tons of CFC-12. Due to the growth in the sectors, we estimate that consumption has increased 7% during 1993, and will increase an additional 6% during 1994. Both substances are produced domestically (660 tons of CFC-11 and 772 of CFC-12, and are also imported (1048 tons of CFC-11 and 1990 tons of CFC-12).

PROJECT OBJECTIVE

The objective of the project is the complete elimination of the use of chlorofluorocarbonated compounds in the manufacture of domestic refrigerators in the plants of the company NEBA S.A. located in San Fernando del Valle de Catamarca, Provincia de Catamarca, Argentina. CFC-11 used as foaming agent in the production of polyurethane foams used in thermal insulation will be replaced by cyclopentane, and CFC-12 used as a refrigerant will be replaced by HFC-134a in the refrigerating system in the domestic refrigerators. The project does not intend to increase installed capacity.

SECTOR BACKGROUND

In 1992, 1441 tons of CFC-12 and 33 tons of HCFC-22 were consumed in the refrigeration sector in Argentina, in the refrigeration circuit. This sector is the largest consumer of ODS. In the refrigeration sector 440 tons of CFC-12 were consumed in the domestic sector of which 190 tons are used in new equipment and 250 tons are used for servicing operations. With respect to the commercial refrigeration sector, the consumption is 668 tons of CFC-12 (68 tons for new equipment and 600 tons for servicing operations) and 333 tons of HCFC-22. Refrigerated transport and the fleets consume 333 tons of CFC-12.

With respect to the foams sector, in 1992 the sector consumed a total of 1274 tons of CFC-11 and 209 tons of CFC-12 (second largest consumer), of which 322 tons of CFC-11 were consumed in the production of insulating foams for domestic refrigerators, and 21 tons for commercial refrigerators. The production of domestic refrigerators in 1992, based on the Country Program, was equal to 761,000 units. This number grew by 7% in 1993, and there is an estimated growth rate of 6% for 1994.

The domestic sector produces refrigerators and freezers. It is basically composed of more than 22 enterprises, of which 7 control approximately 72% of the market. Of these 7 enterprises, 2 are of foreign capital and the other 5 are 100% national capital. The principal industries have expressed the will to immediately replace the CFCs. A part of them already use the CFC-reduced foaming process.

Some of the CFCs are produced locally and some are imported. With respect to the compressor, the local industry provides 30% of the market, and the remaining 70% is imported mostly from Brazil. The establishment of MERCOSUR (common market of the southern cone) is leading to increases integration with Brazil, resulting in the import of some components from Brazil. An unrestricted demand of CFCs in the domestic refrigeration sector would result in estimated consumption of 1770 tons by the year 2000. The strategy of the Argentinean Government for the phase out of ODS consumption is clearly set forth in the County Program, which considers the domestic refrigerators sector to be a priority. The program for reduction and elimination of consumption in the domestic refrigeration sector establishes the schedule for the reduction in consumption of CFCs to begin after 1995 for foam applications after 1996 for refrigeration circuit applications, and reaching total elimination of consumption in the production of new equipment in the year 2000. The approval of this project by the Multilateral Fund undoubtedly will contribute to the implementation of the planned strategy and the achievement of the objectives of ODS.

ENTERPRISE BACKGROUND

Neba S.A. is a young company, founded in November 1985 in Catamarca city. In January 1986 began production, taking advantage of the experience gained by the ancestor company NEBA S.R.L. Neba produces refrigerator with own designs, and an integration of 60% of the components.
In this moment, and taking into account the export possibilities to MERCOSUR countries, NEBA is looking for new markets in this countries. A brief summary of the company situation is given below:
Annual ODS consumption: 29 tons: 5 tons of CFC-12 and 24 tons of CFC-11

Installed capacity: 52.800 units per year

Total production: 31.000 units per year (based 1994)

Product Market: Local

Source of the present technology: Developed by the company

Enterprise ownership: 100% national capitals

PROJECT DESCRIPTION

This project is designated to replace CFC-11 with cyclopentane for foams, CFC-12 with HFC-134a as refrigerant for the refrigeration circuit, and eliminate the methylene chloride used as a cleaning agent. Project implementation, personnel training needed to operate the new technologies will take 24 months.

FOAMING SYSTEM RE CONVERSION

To replace the CFC-11 used as blowing agent of the polyurethane foams, Neba S.A. has decided to eliminate the step with a transition substance and reconvert its installations and processes to use cyclopentane. Presently NEBA S.A. performs the following processes:

* manual cabinets and doors preparation.
* manual placement in mold.
* pneumatic opening and closing of molds
* molds heated electrically
*polyurethane foam injection, manual injection head movement.

* cleaning of injection heads with methylene chloride. consumption: 37 liters per day

The replacement of CFC-11 by cyclopentane requires the changes listed below and that are part of this project:
- a tank for the bulk reception of cyclopentane that complies with the safety requirements corresponding combustible liquids.
- fire extinguishing installation with sufficient sensors and located in storage areas as well as work areas,
- pre-mix equipment for cyclopentane with polyol adapted for the use of flammable and explosive substances.
- change of the low pressure injection machine for high pressure injection machine, able to handle cyclopentane, which eliminates the use of methylene chloride. Neba proposes to use the same machine for cabinets and doors. one injection head with a nitrogen sweeping valve for cabinets foaming, and another one for door foaming, each of one will be contained inside a chamber with its own functioning and emergency ventilation chamber .
- the conversion from 100% CFC-11 as blowing agent to cyclopentane technologies, implies a thickness insulation increase. being necessary to replace the actual molds. which are also heated by gas through air.
- present gas preheating ovens have to be changed
- all machinery and installations will be explosion proof and grounded.
- safety technicians will study the requirements for the installations before execution of the project and will audit the construction and the start-up of the plant.
- the beneficiary will negotiate a comprehensive technology partnering agreement in order to ensure appropriate technology transfer and assign responsibility for the overall safety of the installation.

The following table shows the present and the required equipment:

CFC-11	CYCLOPENTANE
1 Injection machine. low pressure. CANNON Model C 30 origin Italy for cabinets foaming cabinets with the corresponding water chillier Capacity: 15 - 30 kg/min. Cabinets molds: pneumatic moved heated by electric resistance Production: 150 cabinets per day	1 Injection machine. PERROS. Model HFPE. high pressure for cabinets and door foaming, with the corresponding feeding and premixing group. Capacity: 9.3 - 20 kg/min. for doors 46,8 - 93 kg/min. for cabinets Preheating oven. 4 molds heated by water. with the corresponding ventilation and extraction group. sensors and safeties. (Two molds are going to be provided by NEBA in order to achieve cost effectiveness factor) Production: 150 cabinets per day
Doors foaming system: multiple press with 6 molds	Multiple press for door injection, 3 molds, with the corresponding ventilation and extraction group. sensors and safeties.

REFRIGERATION SYSTEM RE CONVERSION

The current charging process of CFC-12 consists of the injection in liquid state of the pressured liquid (12 bar) after the machine sense the correct previous vacuum. according to the following sequence:
* through a transport band. the refrigerator comes in the pre vacuum area.
* 5 vacuum pumps produce vacuum in the high and low pressure part of the refrigeration

system.
* immediately CFC-12 is charged through the corresponding machine, to produce final vacuum and charge dose
* two points for leakage detection (chlorine detectors)

Modifications to be introduced are the following:
- the existing vacuum pumps have to be replaced, according to GALILEO, they can not be retooled.
- a new charge machine, with corresponding refrigerant supply unit has to be provided.
- new leakage detectors adequate for HFC-134 a have to be provided, the old ones detect only chlorine.
- the present portable vacuum and charging unit has to be replaced, this machine is used for servicing purposes in the plant.
-the refrigeration system has to be optimized for the use of HFC-134a, through testing of compressors, dehydrating filters, capillary tubes in spite of the less refrigerant flow.
- all the refrigerator models have to be tested for compliance with IRAM 2120 Parts 1 to 4, national standards that are in effect in Argentina.

NEBA does not have a formal technology transfer partner. The present CFC-12 technology has been developed by the company itself. The company is now performing some tests with HFC-134a on several units. In other projects approved by the Fund, the compressor suppliers are going to give technical support for the conversion. However the assistance of an international expert is provided.

The following table shows the present and the required equipment:

CFC-12	HFC-134a
VACUUM 2 pumps, GALILEO TEC TYPE D 045 3 pumps, GALILEO OFFICINE V2 AE	5 vacuum pumps GALILEO VACSOUND D 18 ECO 18 m3/hour
REFRIGERANT CHARGE: 1 charging machine OFFICINE GALILEO TYPE V 210 FP 1 charging machine ROBINAIR mod 102323 A, Serial 0297, portable	1 charging machine for HFC-134a EMAC 25 1 charging machine ROBINAIR Mod 34400, portable. (to be provided by NEBA)
REFRIGERANT LEAKAGE DETECTION 2 Chlorine detectors, IFICON, model HLD 300, one for production and one for service	1 Halogen leak detector YOKOGAWA

JUSTIFICATION OF THE TECHNOLOGY SELECTED

Replacement of CFC-11

For the foaming technology, there are presently three replacements for insulation in domestic refrigerators, water/HCFC-141b, water/HCFC-22 and -141b blend or HFC-134a and -152a blend, and cylopentane. The first solution is an aqueous solution whose technology is similar to the one used now, but it is a transitional substance because HCFC-141b is as transition substance, and as such is controlled by the Montreal Protocol, and the government policy is to support projects with definite solutions when feasible. The second solution uses blends of foaming gases, requires totally new equipment, and its start up is difficult and troublesome. The third solution, the one proposed in this project, is cyclopentane technology, which has been successfully introduced in European countries, most notably in Germany. The installation of cylopentane require special considerations for safety problems due to its flammability, but there is considerable experience in Argentina in the handling and storage of hydrocarbons, since

Argentina has a considerable production of hydrocarbons, used as Fuel including automobiles. This substance is available in the market at a cost approximately 50% that of HCFC-141b. In addition, there is experience in the country in operating high pressure machines for foaming. The supplier of the high pressure equipment will guarantee the proper technology transfer of cyclopentane to Neba S.A. (offering an Operational Safety Statement), as well as the global guarantee on the safety of installation by sending safety experts who will audit the installation.

Replacement of CFC-12

There are two options for replacement of CFC-12 as a refrigerant: HFC-134a and hydrocarbons. HFC-134a has been selected for replacement of the CFC-12 refrigerant in domestic refrigerators because it is presently accepted worldwide, and its technology has been developed thoroughly and has been introduced commercially in many developed countries. There are numerous suppliers of gas, oils and components of the circuit, and it appears to be a unique solution in other subsectors such as commercial refrigeration and the automotive industry. There are certain doubts concerning its GWP, but there are no nearby dates for its limitation. The option of using hydrocarbons as refrigerants has been developed in Germany and units are being manufactures with isobutane. It may appear to be a promising technology, but NEBA S.A. thinks that there is not enough industrial experience to adopt this technology.

PROJECT TOTAL COSTS

CAPITAL INCREMENTAL COSTS

Due to the cost effectiveness limits established during the XVI Meeting of the Ex. Com. the company has modified its original project and **the required installation includes only the basic elements to allow the conversion. In order to convert the facility to a comparable production facility with the new technology, the company will assume charges for some components such as two molds for cabinets, some automatic devices, some tests and the raw material needed for trials.**

The total investment asked of the Fund for the procurement of the new equipment, installations, development and training costs , detailed in Annex 1 is U$S 721.070. For the imported equipment, the prices detailed in annex I are the F.O.B. value according to the supplier's quotation. C.I.F. cost, including insurance, amounting to 5% of F.O.B. was added. Contingencies are going to be covered by Neba.

A project costs summary is included below:

EQUIPMENT	U$S
1. Foaming system	571.410
2. Refrigeration system	64.260
3. Technology transfer and technical assistance: Foaming Refrigeration	40.000 18.500
5. Training: Foaming Refrigeration	4.500 5.000
6. Text and trials: Foaming Refrigeration	8.700 8.700
7. Contingencies 10%	to be covered by Neba
TOTAL COSTS	721.070

The Argentine Government will be responsible for destruction of the replaced equipment.

INCREMENTAL OPERATIONAL COSTS

To achieve cost effectiveness threshold limits, the company does not ask incremental operational cost, but anyway a detailed calculation is given in Annex II, a summary is included below.

Phase out cost of CFC-11 per unit	**U$S 1,288**
Phase out cost of CFC-12 per unit	**U$S 4,635**
Total operational incremental cost per unit	**U$S 5,923**
Number of units produced per year	**31,000**
Total operational incremental costs	**U$S 183.613**

PROJECT TOTAL COSTS

a. Capital Incremental Costs	**U$S 721.070**
b. Incremental Operational Costs	**U$S 0**

PROJECT TOTAL COST U$S 721.070

Cost Effectiveness:

A) Capital Cost : U$S 721.070

B) Safety related issues: ISC1: U$S 233.500

ISC2: U$S 96.600

ISC1 + ISC2: U$S 330.100

C) Operational incremental costs: U$S 0

D) ODS reduction : 29.000 kg/year

Cost effectiveness = (A+C-B)/D = 13,48 U$S/kg/year

PROJECT FINANCING

Neba S.A. request the donation of 100% of the project costs, reflecting the 100% local ownership calculated on:

U$S 721.070

PROJECT EXECUTION

The World Bank jointly with the National Institute of Industrial Technology will supervise the project implementation.

TIMETABLE

The project execution demands two years, see below a preliminary schedule:

TIMETABLE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Project description	x																							
Final project	xx																							
Mailing of the legal documents		xxx																						
Financial agreements		xx	xxx																					
Document signing				xxx	xxx																			
Disbursements						xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx
Execution of detailed workplan						xxx																		
FOAMS																								
Equipment Selection							xxx																	
Safety project								xxx																
Equipment procurement								xxx	xxx															
Equipment construction								xxx	xxx	xxx	xxx	xxx	xxx											
Cyclopentane system procurement									xxx	xxx														
Building of cyclopentane installations											xxx	xxx	xxx	xxx										
Safety audit															xxx									
Initial trials																xxx	xxx							
Training of Personnel																xxx	xxx							
Start up																							xxx	xxx
REFRIGERANT																								
Models redesign							xxx	xxx	xxx															
Personnel training										xxx														
Equipment selection									xxx															
Equipment procurement										xxx	xxx													
Installation												xxx	xxx	xxx										
Prototypes production and tests															xxx	xxx	xxx	xxx	xxx	xxx				
Start up																					xxx	xxx	xxx	xxx

PROJECT IMPACT

This project will eliminate the use of, at least 5 tons of CFC-12, 24 tons of CFC-11 and 37 tons of methylene chloride in the first year of implementation.

LEGAL REPRESENTATIVE OF NEBA S.A.

The following person will represent the company for document signing:

President: Mr. JOSE JACINTO DIAZ

ANNEX I

Description	Quantity	Unit Cost U$S	Total Cost (F.O.B.) U$S	ISC1 (direct) U$S	ISC2 (indirect) U$S
FOAM SYSTEM A) EQUIPMENT					
1. Storage area. Conditioning. cyclopentane tank, gas detectors. ventilation and extraction system	1	30.000	30.000	30.000 (1)	
2. Injection System PERROS for cabinets foaming cabinets including: * Preheating oven * Two masks (Neba will buy another two) * Transport car for the injection head * Electrical wiring and panel * molds	1				(2)
3. Injection unit PERROS for cabinets and doors, two speed, injection head for cabinets.	1				(3)
4. Premising unit - Economix	1				(4)
5. Injections Systems for door foaming with 3 masks heated by water, including: * Hydraulic unit and connections * Electric hiring and panel * Injection car (without motorization)	1				(5)
6. Injection Head for doors, electrical wiring and installation	1				(6)
7. Ventilation and extraction system for cyclopentane, including: * gas detectors for molds * nitrogen sweeping system for molds *ventilation and extraction system for injection heads *gas detectors an monitoring system for injection zone * nitrogen sweeping system for injection machines * boxes for door and cabinets foaming * premising unit	1				(7)
	Subtotal	484.200	484.200	120.000	92.000
8. Fire protection system	1	30.000	30.000	30.000 (8)	
9. Shipping and insurance (CIF costs) (5% of the F.O.B. value)			27.210	9.000	4.600
TOTAL			571.410	189.000	96.600
B) TECHNOLOGY TRANSFER AND TECHNICAL ASSISTANCE					

1. Technician for supervision of safety system, one week	1	15.000	15.000	15.000 (9)	
External consultant: engineering, lay out, electrical areas codification, plant modifications, control and monitoring of re conversion	1	25.000	25.000	25.000 (10)	
TOTAL			**40.000**	**40.000**	
C) TEST AND TRIALS					
1. Foaming test in cabinets: 6 models x 15 units per model (raw materials)	90	100	to be covered by Neba		
2. Type Testing according to national standards in a national laboratories (INTI), 1 units per model	6	1450	8.700		
3. Follow up of field test, 50 units	50	60	to be covered by Neba		
TOTAL			**8.700**		
D) TRAINING					
1. Technicians, 1 week, supplier plant	1	3.500	3.500	3.500 (11)	
2. Fire fighting course	1	1.000	1.000	1.000(12)	
TOTAL			**4.500**	**4.500**	
REFRIGERATION SYSTEM					
A) EQUIPMENT					
1. Charging machine HFC-134a, EMAC 25, Robinair	1	29.700	29.700		
2. HFC-134a dosing pump for charging machine Robinair	1	6.800	6.800		
3. Vacuum pumps VACSOUND, with accessories.	5	3.940	19.700		
4. Leak detector system for HFC-134 a: Detector Sensor Filter for tests Maintenance Kit Filters Kit	1	5.000	5.000		
6. Portable charging machine with recovery system for HFC-134a, ROBINAIR, Model 34400	1	3.760	to be covered by Neba		
7. Shipping and insurance costs (CIF costs, 5% of F.O.B. costs)			3.060		
TOTAL			**64.260**		
B) TECHNOLOGY TRANSFER AND TECHNICAL ASSISTANCE					

1. International expert review of concept		15.000	15.000		
2. Technical assistance for charging system provided by supplier. one technician. one week		3.500	3.500		
TOTAL			**18.500**		
C) TEST AND TRIALS					
1. Destructive evaluation and test of the refrigeration circuits. 2 units per model. 6 models	12	300	to be covered by Neba		
2. Type testing according to national standards in national laboratories (INTI). 1 units per model. 6 models	6	1450	8.700		
3. Follow up of field test. 50 units -	50	300	to be covered by Neba		
TOTAL			**8.700**		
D) TRAINING					
1. Training of personnel during implementation and start-up			5.000		
TOTAL			**721.070**	**233.500**	**96.600**

NOTES:

(1) Conditioning of the storage area. to comply with the safety issues related to cyclopentane.

(2). (5) and (6) Estimated costs debt to the safety needed to use Cyclopentane. instead of HCFC-141b, including valves. box. fans. switches. motors. electrical wiring and board explosion proof according to IP55 standards and grounding

(3) Cost related with the nitrogen pressurization system. installation and electric wiring according to IP55 standards. ventilation system. ducts and fans. box for ventilation systems and gas detectors. based on first supplier quotation and grounding

(4) Corresponding to the difference between the cost of an injection machine adequate to use cyclopentane and the cost of the same machine for HCFC-141b.

(7) and (8) Safety system needed only if cyclopentane is used.

(9). (10). (11) and (12) Technical assistance. control and supervision of the safety related issues for the foaming installation.

ANNEX II

1. CFC-11 phase out:

Foam present composition
Foam weight per unit : 5 Kg.

Isocyanate	100p.p.	37 %	1,85 Kg.	2,11 U$S/kg	3,9 U$S	
Polyol	130p.p.	48 %	2,4 Kg.	2,11 U$S	5,1 U$S	
CFC-11	40p.p.	15%	0,75 Kg.	2,5 U$S	1.875 U$S	
					10.875 U$S	

Foam composition using cyclopentane
Foam weight per unit: 5 Kg.

Isocyanate	144p.p.	56,25 %	2,81 Kg.	2,11 U$S		5,929 U$S
Polyol	100p.p.	39,00 %	1,95 Kg.	2,90 U$S		5,655 U$S
Cyclopentane	12p.p.	4,68 %	0,24 Kg.	2,21 U$S		0,519 U$S
						12,103 U$S

Total Cost of CFC-11 phase out : 12,103 - 10.875 = 1,228 USS

2. CFC-12 phase out:

Compressor replacement for R-134a
CFC-12 compressor price : 36,5 U$S
HFC-134a compressor price: 39,5 U$S
Difference : 36,5 - 39,5 = 3,0 U$S

CFC-12 replacement by R-134a:
Present refrigerant charge: 150 gr.
CFC-12 0,150 Kg. x 3,50 U$S/Kg.= 0,525 U$S
HFC-134a 0,135 Kg. x 16 U$S/Kg.= 2,16 U$S
Difference : 2.16 - 0,525 = 1,635 U$S

CFC-12 total phase out operational cost : 4,635 USS

CFC-11	1.288 U$S
CFC-12	4.635 U$S
Total per Unit:	**5,923 USS**

Total per year (base 1994): 5,923 USS per unit x 31.000 units = 183,613 USS

Country of origin: ARGENTINA

Project title: Elimination of CFC in the manufacturing plant of domestic refrigerators of NEBA S.A.

Sector/sub-sector Domestic refrigeration

Relationship to country program (World Bank)

Note ***This review addresses only the refrigerant conversion part of the project, it does not address the part related to the foam blowing agent conversion.***

Technology

- In this project HFC-134a is selected as the substitute refrigerant for CFC-12. In domestic refrigeration HFC-134a technology is a proven and acceptable (nontransitional) technology to reduce CFC-12 consumption.
- The company NEBA S.A. does not have a formal technology transfer partner. The company intends to develop the HFC-134a technology with support from the compressor and equipment suppliers. Furthermore external support will be asked for, provisions for this support are included. Due to these facts, a successful project implementation can be expected.
- Other technologies than HFC-134a were considered (hydrocarbons) but were not selected because of the development state which was considered to low by the company. From the zero ODP technologies, HFC-134a is one of the most cost effective solutions.

Environmental impact

HFC-134a has an ODP of zero and a GWP of 1300. For domestic refrigeration a GWP of this magnitude is negligible.

Project costs

Remarks from a previous review were correctly addressed.
Incremental investments:

- The equipment requested is essential for the conversion process and costs are reasonable.
- Costs of training and technical assistance are reasonable.
- A large part of tests and trials costs are incurred by the company.

Incremental operational costs:

- Operational costs are calculated correctly but no funding for these costs is being claimed.

The UAC value, calculated for the refrigerant part separately, amounts to 3 USD/kg/y which is very low compared to other, similar, projects (mainly because no operational costs are claimed)

Implementation timeframe Reasonable

Relevance and adequacy of information provided Reasonable

Recommendations Approval as proposed

Janssen M.J.P.,OORG MM338, Eindhoven, The Netherlands, 10-May-1995

ARGENTINA - NEBA

TECHNOLOGY

The refrigerator manufacturer NEBA is proposing to replace CFC 11 in the insulating foam by cyclopentane. Cyclopentane technology is in wide scale use in Europe and elsewhere and is a well proven technology with over 10 million units being produced since its introduction in 1993.

Other technologies were considered, including those based on HCFCs and HFCs. HCFC technologies are rejected because they are not zero ODP and hence not in line with Argentine government policy. The gaseous HFCs require new equipment and are difficult to use. Furthermore, they are not used by the industry in any country.

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Cyclopentane has a zero ODP and, in terms of ozone depletion, represents a long term solution.

The enterprise should realise that cyclopentane is a VOC and ensure that it will satisfy any regulations controlling the emissions of such substances.

The safety issue due to the flammable nature of cyclopentane is adequately addressed.

The enterprise will obtain from the proposed equipment supplier a guarantee that the installation will provide the required level of safety in operating with highly flammable cyclopentane and the provision of process experts to supervise and audit the equipment and its operation.

PROJECT COSTS

The overall grant cost effectiveness is within EC limits. The capital items proposed are all justified and are suitable for cyclopentane foaming technology. The enterprise has economised by replacing its current equipment with one high pressure dispensing machine.

The incremental operating costs are clearly set out but are not being claimed by the enterprise.

IMPLEMENTATION TIMEFRAME

This is acceptable.

RECOMMENDATION

Approval.

GMFJ/kd/6/6/95